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### **EXPANSION VERSUS RESTRICTION OF CESAREAN SECTION**

#### **Presidential Address\***

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IN SELECTING the subject, "Expansion Versus Restriction of Cesarean Section," I have in retrospect, covering twenty-five years of practice, become acutely aware of the fact that the practice of obstetrics is rapidly changing.

If the obstetrician of a quarter of a century ago could have foreseen that in 1948 American women could have been delivered of 3,535,068 live infants<sup>1</sup> and that the maternal mortality rate would be 1.2 per 1,000 live births, he would have been astonished. Furthermore, had he been told that the rate in 1948 would be one-fifth that of fifteen years earlier he would have been astounded. On the other hand, what would have been his reaction if he could have foreseen that in 1948 between one-tenth and one-twentieth of all deliveries in some of our leading lying-in hospitals would be by cesarean section, and that many hundreds of consecutive abdominal deliveries could be accomplished with a maternal mortality rate of 1.0 or less per cent?<sup>2, 3, 4, 5</sup> We are witnessing what he could not have believed possible, yet these changes have occurred during the last twenty-five years (Fig. 1).

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\*Presented at the Fourteenth Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Clearwater, Fla., Jan. 24 to 26, 1952.

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Not too many years ago the obstetrician could keep well in mind the number of cesareanized patients on his prenatal list. Not so at the present day. It is now necessary to list separately the increasing number of such patients, who pose serious problems.

Without minimizing the inestimable lifesaving value of cesarean section to mothers and babies, it must be admitted that this is the only obstetric operation performed in pregnancy or labor which may seriously jeopardize maternal and fetal life in any subsequent pregnancy. It is, therefore, appropriate to analyze critically the present-day trend toward widening the indications for cesarean section and determine to what extent it would seem to be unjustified. To this end, a few condensed and summarized figures will be cited from recent obstetric literature and from experience gained in private practice.

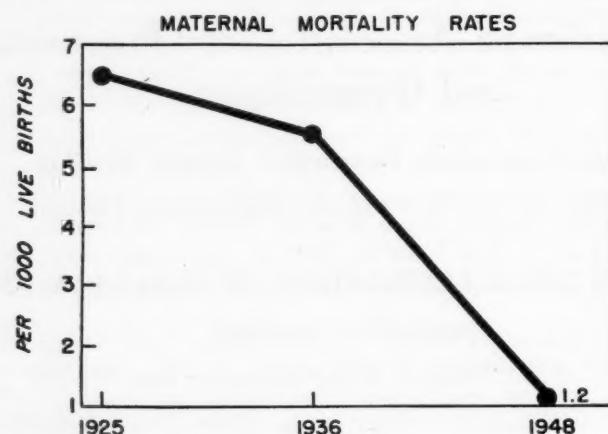


Fig. 1.

*Why is there such a wide discrepancy in the incidence of cesarean section?*

It has been estimated that 2 per cent of all American women are delivered by cesarean section.<sup>6</sup> Among the larger hospitals the incidence varies between 0.5 and 14.0 per cent<sup>49</sup> (Table I). In a composite study of four large lying-in hospitals the average rate was 6.2 per cent.<sup>49</sup> The incidence in private cases is increased threefold over that for ward cases.<sup>22, 41</sup> Why the variations?

TABLE I. CESAREAN SECTION RATE

PLACE	PER CENT
Woman's Hospital, New York <sup>49</sup>	14.0
Good Samaritan, Los Angeles <sup>62</sup>	9.7
Cedars of Lebanon Hospital, Los Angeles <sup>7</sup>	9.4
Kansas City <sup>48</sup>	7.1
Larger Manhattan Hospitals, Average <sup>49</sup>	6.2
Cleveland Maternity <sup>48</sup>	6.1
Philadelphia Lying-In <sup>48</sup>	5.8
Chicago Lying-in <sup>60</sup>	5.0
Margaret Hague <sup>61</sup>	4.1
Duke University <sup>22</sup>	1.8
Univ. of Cincinnati, College of Medicine <sup>48</sup>	1.6
Emory University (Ward)	0.5

### Factors Tending to Promote Expansion of Cesarean Section

While the over-all average incidence of cesarean section in the United States has risen to 2 per cent,<sup>8</sup> in some institutions the rate is much higher and it is regarded as either necessary or justifiable to deliver one out of ten mothers by cesarean section. It is pertinent to consider what factors have encouraged this tendency to substitute surgery for many of the obstetric difficulties which formerly were handled conservatively.

1. *Increased Hospitalization.*—During the past twenty years hospital admissions in the United States have about tripled. Hospital deliveries have increased from 600,000 to 2,800,000—a four- to fivefold increase during this period<sup>1</sup> (Fig. 2). A most favorable environment has, therefore, been provided for the unsupervised incompetent operator as well as for the well-trained but surgically inclined obstetrician. Compulsory consultation has lagged behind the need for safeguarding this situation in the average hospital.

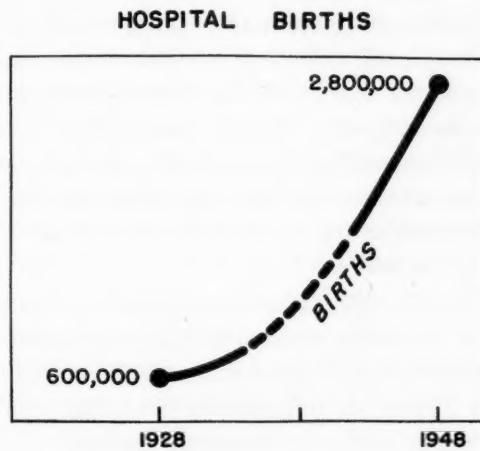


Fig. 2.

2. *Prophylaxis Against Infection.*—Greater availability of blood and prophylactic use of the sulfonamides and antibiotics have provided greater protection against infection and have no doubt encouraged resort to cesarean section in cases where fear of peritonitis otherwise would have compelled the use of conservative rather than operative measures. The mortality in cesarean section performed in well-organized obstetric centers is now unbelievably low. Dieckmann<sup>2</sup> reports a rate of 0.42 per cent in 2,871 operations performed from 1949 to 1951, but does not admit the anti-infectious agents contributed to this remarkable record. If not, the decision to employ cesarean section must have been made before conservative measures permitted potential hazards to develop. Marshall,<sup>3</sup> prior to 1939, performed 246 low-segment operations without a maternal mortality.

Montgomery<sup>9</sup> has said, "morbidity is the mother of mortality." Perez<sup>10</sup> combined intraperitoneal sulfonamide with penicillin preoperatively in cesarean section and reported a marked reduction in morbidity. It would seem

that the proper role of these agents should be on the side of a more thorough trial of conservative measures in an effort to avoid abdominal delivery and at the same time confer a greater degree of protection to the patient, if section must ultimately be performed.

3. *Improvements in Operative Technique.*—The development of operative techniques designed to protect the peritoneal space from spread of infection from the uterine cavity by employment of the low-segment operation, preferably utilizing the transverse rather than the longitudinal incision in the uterus, has widened the use of cesarean section. In the opinion of most operators, the low-segment operation, by transperitoneal approach, confers adequate protection, except in neglected or frankly infected cases in which the true extraperitoneal cesarean section is preferable. Keettel<sup>11</sup> recently reported 1,152 extra-peritoneal sections performed in thirteen clinics with a maternal mortality of 1.0 per cent. Cosgrove<sup>5</sup> reported 1,068 extraperitoneal operations with a mortality rate of 0.56 per cent.

To the average operator, particularly the general surgeon in rural areas or small community hospitals, cesarean section means the classical operation. He is not familiar with the merits of the low-segment operation or else considers it technically too difficult. When encouraged by the recommendation and example of highly specialized maternity hospitals to extend the use of cesarean section, he concurs but still employs the classical operation. Only by education can mortality statistics on cesarean section at this level of obstetric practice be expected to improve.

4. *Influence of Training Centers.*—An attitude of greater leniency toward a wider application of cesarean section to obstetric complications, as may be apparent in published writings from some representative maternity centers, is undoubtedly a strong factor in influencing obstetric thought at all levels of practice and raising the incidence of cesarean section.

Likewise, the students and residents trained at these centers hold to the same belief and further disseminate the same attitude and policy. It is to be emphasized that a considerable degree of acceptance of this attitude does not prove it to be correct as we hope to show in discussing the indications and potential dangers of cesarean section. Jellett<sup>12</sup> states, "The desire to do an unnecessary cesarean section is a disease begot of furor operandi out of obstetric ignorance. There is danger of exalting technic at the expense of sound judgment."

5. *Roentgen-Ray Pelvimetry.*—The value of roentgen-ray pelvimetry as an adjunct to appraisal of possible factors in dystocia cannot be denied. In many clinics it is a routine procedure in evaluating pelvic capacity. Weinberg and Seadron,<sup>13</sup> using four standard techniques for pelvimetry, found a variation of not more than 0.1 cm. Savage,<sup>14</sup> comparing the prognostic accuracy of the obstetrician's and radiologist's predictions as to the outcome of labor in 200 cases from a dystocia clinic, found the obstetrician correct in 95.2 per cent and the radiologist in 88.9 per cent. The radiologist predicted a need for cesarean section in 17 cases in which, however, delivery was successfully accomplished.

through the pelvis. Wilson<sup>15</sup> found a prognostic error of 25 per cent among 24 women formerly delivered by cesarean section based on radiological findings but who subsequently delivered safely through the vagina. He points out the fallacy of being guided solely by roentgen-ray measurements. Keettel and Randall<sup>11</sup> state that neither clinical nor roentgen-ray pelvimetry is of value in determining the method of delivery prior to the onset of, or even early in, labor. Hunt,<sup>16</sup> in evaluating the worth of a test—not trial—of labor, admitted that earlier experience with roentgen-ray evaluation had led to undue concern in regard to some pelvis. It is our own belief that, except in the well-organized maternity centers, too much pathology and unfavorable prognosis are read into many roentgen-ray films of cephalopelvic relations.

Henderson,<sup>17</sup> in a composite study of the indications for cesarean section in nine hospitals, pointed out a wide discrepancy between 21.4 and 58.4 per cent in the diagnosis of cephalopelvic disproportion. As might be expected, it stands first or second in the list of indications for cesarean section but is a loose term susceptible not only to much variation in interpretation but to inaccuracy due to the impossibility of assessing correctly the behavior of the fetal head and the efficiency of the uterus during labor.

*6. Fetal Safety.*—The fallacious belief on the part of both the laity and some of the profession that delivery by cesarean section insures safety for the fetus contributes to some of the increasing use of cesarean section. Huber<sup>18</sup> in an analysis of 606 cesarean sections found the gross fetal mortality was 14.6 for 1,000 deliveries greater for cesarean section than for vaginal delivery. He found that 67.9 per cent of the loss was neonatal and 27 per cent of the neonatal deaths were among term infants. Lamb,<sup>19</sup> Low,<sup>20</sup> and others<sup>21, 22</sup> report similar results. Bachman<sup>23</sup> found much of the mortality occurring in the premature group. Landesman<sup>21</sup> has shown that the fetal risk in routine repeat cesarean section near term is greater than in abdominal delivery for cephalopelvic disproportion after a trial labor, due to anesthesia and miscalculation of maturity.

Landau<sup>24</sup> attributed some of the infant loss to a lack of conditioning the fetus naturally receives during normal labor. His interest centered in the group of infants delivered by cesarean section initially, seemingly in good condition, but who developed respiratory complications and died within a few hours. He also considered the loss of 30 per cent of the fetal blood to the placenta by immediate clamping of the cord to be a factor but the same factor apparently is without detriment in many normal births. It is obvious that at the time of birth of the head in normal labor, the fetal chest is compressed sufficiently in the narrower pelvic outlet to squeeze from the respiratory passages of the infant most of the amniotic fluid and mucus which otherwise in cesarean section would be aspirated deeper into the lungs at the first inspiration.

Of all the complications treated by cesarean section and resulting in premature infants, only the groups with diabetes and placenta previa have shown an improvement over vaginal delivery. In contrast to an over-all fetal mor-

tality of 3 per cent by normal delivery, the loss associated with cesarean section is between 4.9 and 10.8 per cent<sup>21</sup> (Table II). The evidence, therefore, does not support the contention that delivery by cesarean section is a factor of safety to the fetus.

*7. Remuneration and Convenience.*—It would be better, if these factors are discussed at all, that it should be done frankly and not by innuendo. In these days we hear much about the seeking of higher wages and shorter hours of work. Perhaps, without realizing or intending it, the phrase has come to have some degree of application to the increasing use of cesarean section.

A thorough and unstinted airing of these twin influences is long overdue. How does it happen that the incidence of cesarean section is three times as high<sup>22, 41</sup> among private as among ward patients? Certainly the incidence of obstetric complications is not related to the economic status to this degree.

The doctor's suggestion during pregnancy that a cesarean section may be necessary for delivery conditions the patient's attitude in advance for ready consent with the advent of pain. If the presumable indication is of a vague character such as borderline cephalopelvic disproportion or uterine inertia, very little cooperation can be expected on the part of the patient or her family in testing the validity of the indication. An unnecessary section is therefore more likely to be performed.

TABLE II. FETAL MORTALITY IN CESAREAN SECTION<sup>21</sup>

PLACE	PER CENT
Boston Lying-in Hospital	6.8
City New Orleans	10.8
Chicago Lying-in	9.2
Johns Hopkins	6.0
New York Lying-In	7.7
Methodist Hospital, Brooklyn	4.9
Philadelphia Lying-In Hospital	9.2

Not infrequently one examines a patient who was previously cesareanized for supposed contracted pelvis, having had no test of labor and whose infant was less than average in weight. On finding the pelvis to be of sufficient size, is the attendant unjustly critical if he substitutes "remuneration and convenience" for the original indication and feels somewhat resentful that he must inherit the potential complications of the situation thus set up?

It is a constant source of wonder to observe the readiness with which many patients accept without question or suggestion of consultation the physician's recommendation of cesarean section to solve an obstetric problem. The trust confided by a woman in her physician permits much flexibility of action should he be possessed of much flexibility of conscience.

Cesarean section is surrounded by much glamor in the mind of the laity. Women and their families are so naïve in their obstetric thinking that they believe cesarean section a "gimmick" which can be used under any or all circumstances. The popular magazines might render a distinct service to woman-kind by debunking much of this misunderstanding and stressing some of the potential dangers as well as the true values of this operation.

A flexible conscience is existent to probably no greater degree in a cross section of physicians than in any other profession or means of livelihood. That cesarean section has not been aligned with phantom operators at certain levels of practice may be due to the restraining influence of the doctor's own signature on the birth certificate or to the simplicity of the operation itself. Whether by intent or unexpected thriftiness on the part of the E.M.I.C. project during the recent war, a provision of no extra remuneration in case of cesarean section undoubtedly exerted a very restraining influence on the incidence of section in this segment of our population.

Compulsory and free consultation would reduce much unwarranted resort to cesarean section. This, together with a pledge that the stipulated fee for all-inclusive care of an obstetric patient should also include possible cesarean section delivery, would eliminate undesirable incentives and demonstrate a precipitous drop in the over-all incidence of delivery by cesarean section.

To appreciate the part played by convenience in raising the incidence of cesarean section, one must consider the qualities which best adapt an obstetrician to his specialty. Aside from his professional fitness, he should have deep respect for the capabilities of Nature and much of that quality which Osler termed *Equanimitas*. He should not be imbued with an attitude toward labor that "it is later than you think." There should be a willingness to forego a planned mode of life and avoid the temptation to intervene for convenience' sake when Nature may be doing well enough. He should accept difficult and prolonged labors as a challenge to his skill, patience, and the art of his specialty, and pride himself rather in assisting Nature to a successful conclusion, which is possible in the vast majority of labors, leaving his patient functionally intact for future pregnancies, thus avoiding limitation of family and added economic burdens of operative deliveries. There must be obstetric stamina in the obstetrician's make-up to withhold sedation when the need of uterine force is paramount and by patience, firmness, and some measure of sympathy enable the woman to attain the utmost progress.

This code of obstetric practice admittedly makes more demands on the obstetrician's time and physical fitness than a quick resort to cesarean section on the first evidence that labor may be prolonged or unusually difficult, but it pays high dividends in that it does not "muddy the water" and set up potential hazards for future childbearing. Extension of group practice in obstetrics would do much to maintain a conservative policy. Table III indicates that a conservative policy gives good maternal and fetal results and raises a question as to the justification for expanding the use of cesarean section.

There are factors other than those mentioned which have also contributed to an increase in cesarean section incidence but to a lesser degree. In general, the increase is not by reason of new indications. Primarily, it is due to inclusion of borderline or relative degrees of previously recognized indications. In this connection it seems appropriate to discuss briefly some of these borderline indications previously successfully managed in a conservative manner but now so frequently subjected to cesarean section.

TABLE III. GROSS STILLBIRTH AND NEONATAL MORTALITY IN 21,135 DELIVERIES FOR THREE SERVICES CONDUCTED BY CONSERVATIVE OBSTETRIC PRACTICE

PLACE	CESAREAN SECTION INCIDENCE PER CENT	TOTAL DELIVERIES NUMBER	GROSS FETAL LOSS, ALL DELIVERIES PER CENT
Emory Univ. (ward)*	0.5	17,421	3.0
Army hospital†	0.35	1,699	2.0
Private practice‡	1.30	2,015	1.93

\*Emory University Hospital, Atlanta, Ga.

†Station Hospital, Fort Bragg, N. C., Sept. 1, 1942, to May 1, 1945.

‡Roberts, M. H., J.A.M.A. 139: 439, 1949.

### Borderline Indications

1. *Cephalopelvic Disproportion*.—This ambiguous term, responsible for approximately 35 per cent of all cesarean sections, shows a wide variation in incidence from 13.8 to 58.4 per cent.<sup>8, 17, 22, 25</sup>

Wilson<sup>15</sup> recently found, in analyzing 167 successful vaginal deliveries among 498 women previously delivered by cesarean section, that cephalopelvic disproportion or contracted pelvis was listed as the indication in 30 per cent of the unnecessarily cesareanized patients. Furthermore, he found that 38 per cent had been subjected to cesarean section without a test of labor. Others<sup>26, 27</sup> have presented similar evidence of abuse of the operation among women delivered vaginally, subsequent to cesarean section.

In view of what has previously been stated, suffice it to say that, based on the findings at term as to the estimated size and engagement of the fetal head and previous knowledge of the type of pelvic contraction, supported by roentgen-ray evidence in the most questionable cases, the woman should be given a test of natural labor. If the head is well fixed and the cervix thin and dilated 3 to 4 cm., the membranes should be artificially ruptured, which is essential if the test is to have meaning. Ten to twelve hours of efficient pains may be allowed, particularly if prophylactic sulfonamides and antibiotics have been administered. If there is good flexion and the station of the head progresses to between minus one and zero and the cervix dilates to 6 or 7 cm., the prognosis for further progress is good, and assistance, if necessary, will consist of no more than a mid- or low midforceps delivery and possibly incisions in the cervix.

If the head remains high at minus 2 or 3 station and the cervix dilates very little, the transperitoneal low-segment cesarean section will still yield good results.

If the midpelvis and outlet are markedly contracted, a test is out of order and elective section should be performed. The latter type of pelvis is easily recognized. We see very few.

2. *Uterine Inertia*, "Cervical Dystocia," "Prolonged Labor."—These terms, representing factors difficult to assess as to their relative contribution to any case of dystocia, are concerned in 5 to 20 per cent of cesarean sections. Lawrence<sup>28</sup> reported uterine inertia was listed as the indication in 20 per cent

of 2,423 sections performed at the University of Leeds, England. Keettel and Randall<sup>11</sup> attribute a majority of the cervical dystocias and prolonged labors to uterine inertia. They found that 69 per cent of women requiring cesarean section for inertia had normal pelvis. The danger of cesarean section in this group is infection<sup>29</sup> and most of the deaths following transperitoneal section are the result of peritonitis.<sup>30</sup> All too often the general surgeon called late to deliver these patients makes the mistake of using the classical type of operation which affords a minimum degree of protection against peritonitis.

Eastman<sup>31</sup> and others have employed Pituitrin in the treatment of uterine inertia and have reduced the incidence of cesarean section 50 per cent and the use of midforceps 60 per cent in this group of women. More recently, Hellerman<sup>32</sup> has demonstrated, with similar results, the value of intravenous dilute pituitary infusion in the management of uterine inertia. In our practice, the intranasal application of Pituitrin has proved highly efficient as a means of stimulating the uterus in the presence of inertia. Only occasionally is subcutaneous injection of minute doses necessary.

The use of Dührssen's cervical incisions and delivery by midforceps, rather than extraperitoneal or transperitoneal low cervical section or cesarean hysterectomy, for the occasional refractory case has given gratifying results in our hands. Hunt<sup>33</sup> reported the use of Dührssen's incisions and midforceps in a series of 592 cases, with a maternal mortality of 1.18 per cent and a fetal loss of 10.3 per cent. The scarred cervix proved troublesome in only 3.8 per cent of those having subsequent deliveries.

Landesman<sup>21</sup> pointed out the fact that the fetal mortality in prolonged labor terminated by cesarean section is 10 per cent—practically the same as reported by Hunt for vaginal delivery.

3. *Pre-eclampsia and Eclampsia.*—This complication accounts for 4 to 11 per cent of the cesareans performed.<sup>21, 34, 35, 36</sup> In the early part of this century, when it was more universally treated by section, the maternal mortality was 20 to 25 per cent. At present, by induction of labor and conservative treatment, the mortality has been reduced to between 3 and 5 per cent in many clinics. Baird and Assali,<sup>37</sup> of Cincinnati, by the use of Veratrone and magnesium sulfate in combination with conservative treatment, have obtained a maternal mortality of less than 1 per cent in over 200 cases of convulsive toxemia. Faison<sup>38</sup> in 1951 reported that 25 per cent of deaths after cesarean section occurred in cases of eclampsia. In a similar study, Gordon<sup>39</sup> found 17 per cent had occurred in the presence of the complication. Dieckmann<sup>2</sup> reported a fetal loss of 8.4 per cent when toxemic patients were delivered by cesarean section. It is, therefore, far better to utilize conservative treatment rather than cesarean section in the treatment of toxemia.

4. *Abruptio Placentae.*—This severe complication constitutes the indication in from 3 to 14 per cent of all sections.<sup>6, 25, 40, 41, 42</sup> Schmitz<sup>25</sup> found it occupied fifth place in his clinic. Irving,<sup>43</sup> in an analysis of 353 cases of abruptio placentae, found that in 170 cases with external hemorrhage delivery was

through the pelvis with no maternal mortality, but in 30 cases of the same type delivered by cesarean section the maternal mortality was 3.3 per cent. In 103 cases of concealed hemorrhage, the maternal mortality among 69 cesareanized women was 14.5 per cent, in contrast to 2.9 per cent when delivery was through the pelvis.

Gordon<sup>39</sup> showed the futility of electing cesarean section as an effective means of minimizing hemorrhage. He found that out of 15 women delivered by cesarean section, about 50 per cent died of hemorrhage. McCain and Poliakoff<sup>44</sup> reported a series of 293 cases of abruptio placentae treated at Emory University. Cesarean section was resorted to in only 1 per cent. The gross maternal mortality was 4.8 per cent. They showed that postpartum hemorrhage was not a troublesome complication in this series of cases.

Landesman,<sup>21</sup> in 107 cesarean sections for abruptio placentae, found a fetal mortality of 50 per cent. Lamb<sup>19</sup> found it to be 66.7 per cent. The fetal risk is so great that it is seldom possible to save the fetus except in mild cases, and in these cesarean section is still less indicated.

There are still too many cesarean sections performed for abruptio placentae, but the trend is toward vaginal delivery. Labor is easily induced in these patients, even though the cervix may be unfavorable, and they labor rapidly. With blood replacement and supportive treatment, delivery through the pelvis gives as good or better results than cesarean section and leaves no potential risk.

5. *Placenta Previa*.—At present, placenta previa occupies third place among the indications for the operation, constituting the indication in 5 to 27 per cent of all cesarean sections.<sup>25, 41, 42, 45, 46, 47</sup> The operation is employed in the treatment of placenta previa in from 14 to 75 per cent<sup>48, 49</sup> of the cases in the various clinics. According to Irving<sup>50</sup> the mortality of placenta previa decreased from 11.6 per cent prior to 1930 to 2 per cent from 1930 to 1934. Siegel<sup>51</sup> reported a drop from 5.22 per cent prior to 1931 to less than 1.0 per cent since that date. Findley<sup>52</sup> and Pedvis<sup>53</sup> found the fetal mortality to be about 50 per cent. Through the use of expectant treatment, thereby lessening prematurity, Williams,<sup>54</sup> Johnson,<sup>55</sup> and Macafee<sup>56</sup> have reported fetal mortality rates of 12, 22.5, and 23.5 per cent, respectively.

Blood replacement is the all-important factor in the improvement of maternal and fetal mortality in placenta previa. Cesarean section should be a contributing factor, since it definitely and quickly limits loss of blood beyond that which must inevitably be lost with the operation itself.

It is our belief that blood replacement will enable a majority of placenta previa cases to be carried nearly to term, at which time vaginal examination either early in labor or following hemorrhage will be more informative and will enable the attendant to decide between delivery through the vagina or by cesarean section. While there are numerous factors which influence this choice, cesarean section is generally preferable if the placenta, early in labor, is found to encroach upon the cervical opening.

### Subsequent Childbearing After Cesarean Section

What should be the management of subsequent childbearing after the first cesarean section and upon what considerations is it to be based?

Concerning these patients many questions press for an answer. Does the original indication for the cesarean section still apply? Did the uterine incision heal sufficiently well to withstand the strain of later pregnancy or labor? Was the operation of the less dependable classical type? Will the patient recognize the significance of the pain of beginning rupture or will she be overzealous in reporting confusing physiological discomforts in the lower abdomen so common to late pregnancy? As we palpate the site of the former operation, does the woman exaggerate or minimize the degree of tenderness so commonly found in many normal cases late in pregnancy? Are there really any dependable criteria in any given case by which the scar can be judged fit for late pregnancy or labor? If rupture occurs, will the patient happen to be alone or in the near vicinity of the hospital? Will prompt transfer to the hospital be available? Will the operating room be promptly obtainable and blood in sufficient volume available?

There are those who will say that the statistics as to the frequency of cesarean scar rupture do not justify these fears. In reply, one may say it matters not that the frequency of rupture is low. The crux of the situation is that one cannot dismiss these fears and possibilities in their relation to any particular woman. In spite of the so-called criteria of sound healing, there is absolutely no way of determining whether the scar of a previous cesarean section will be safe for future pregnancies and labors, save by risking a delivery through the pelvis and examining the site of the scar at once by combined abdominal and intrauterine palpation after the third stage. It is of doubtful value to take a present risk to avoid a future risk of the same type.

It is generally stated that rupture of the scar of a cesarean section occurs in about 3 to 4 per cent<sup>27, 57</sup> of the cases and more frequently in late pregnancy than in labor. Considering the frequent change of residence, failure to report such cases, and the occasional failure to diagnose the cause of death, this frequency must be definitely greater than is stated.

It is now realized that rupture occurs less frequently in the scar of the low segment operation, particularly in the transverse scar, than in the scar of the classical section. Brierton<sup>57</sup> reports 1.9 per cent rupture in 152 cases, all of which were of the low-segment type of operation. The incidence of rupture of classical scars was 4.2 per cent.

The maternal mortality in cases of rupture of the scar varies from zero to 30.5 per cent according to the reports of several authors.<sup>27, 57, 58, 59</sup> The fetal mortality is naturally extremely high and is stated to vary from 33 to 65.2 per cent,<sup>27, 57, 58</sup> or even more.

There are several factors which render the low-segment scar likely to heal firmly. The healing of an incision in this portion of the uterus is less disturbed by uterine contractions and it is probably more resistant to infection. The

most important factor is the ease with which the transverse incision can be repaired. There is no eversion of the wound surfaces since the operator is able to approximate them accurately and with a minimum of suture tension. In contrast to this, the wound surfaces of the classical incision tend to evert and become obliquely angulated. They can be approximated only with considerable tension of the suture layers, which tends to strangulate the blood supply and predispose to failure of healing through ischemia.

The low-segment scar gives added safety to the mother, since the disrupted incision scar is covered by the bladder flap, which, by preventing free escape of blood, may limit the degree of hemorrhage. There is added safety to the fetus since it is more likely to remain in the uterine cavity and prevent separation of the placenta.

Unfortunately, however, the average operator performs the classical rather than the low-segment operation. He either considers it technically too difficult to perform, and too time consuming, or does not appreciate the immediate advantages in added safety of recovery or future benefits as to subsequent childbearing. He accepts the invitation to perform more cesarean sections but disregards the advice as to technique. For this reason there are numerous cesareanized patients at large, ignorant as to what type of operation has been performed, shifting from one locality to another, often too distant from hospital facilities or good obstetric talent. The physician who is responsible for the care of such a woman may be one who believes a repeat section offers the best assurance of safety to the mother and baby, or he may believe vaginal delivery is feasible. Due to these uncontrollable factors it is quite certain that the immediate mortality of cesarean section is not the ultimate mortality.

Vaginal delivery in this group of women may be justifiable in a well-organized maternity hospital with its own blood bank, operating room constantly set up and available, anesthetists on call, and an alert resident staff to supervise the labor very closely. This is a far cry, however, from a patient in a rural area or small community and for this patient repeat section is far preferable. Even with the facilities of a general hospital, it is impossible to keep an operating room, anesthetist, and personnel constantly at hand during a questionable labor of some duration, in preparation for the emergency of possible uterine rupture.

In this connection it may be interesting to quote a case of which I had personal experience during the preparation of this paper. It may well have been fortunate that one of her obstetricians was on duty at the time she arrived in the hospital.

Mrs. E. B. R. (No. 658-1951) was a gravida ii, due Jan. 18, 1952. The first labor was terminated at term, at the end of 34 hours of labor, in May of 1950 by a general surgeon. The patient was told that the cervix was completely dilated at the time of the operation. The recovery was uneventful and a 7 pound infant survived. On registering for care during the second pregnancy the pelvis was found normal and the location of the abdominal scar indicated that the cesarean section was of the classical type. Repeat section was planned for Jan. 9, 1952. While she was asleep and without warning, the uterus ruptured

on Jan. 2, 1952. Due to the distance and transportation difficulties, admission to the hospital was delayed two hours. When admitted she was pulseless, the blood pressure was unobtainable, the abdomen filled with blood, and the fetus dead. Immediate blood replacement was started and laparotomy performed. A classical scar over the placenta had ruptured and extended extensively, rendering the uterus unfavorable for future pregnancies. A supracervical hysterectomy and massive replacement of blood enabled the woman to recover from shock and survive. The stillborn infant weighed 6 pounds, 7 ounces.

Of course, in retrospect, one can always say that section should have been performed earlier than planned. However, the application of such reasoning to a large group of "repeat section" cases would be productive of a high and unnecessary incidence of fetal loss due to prematurity.

### Conclusions

1. The trend toward employment of cesarean section has rapidly increased during the past fifteen years. It is believed that the over-all cesarean section incidence is 2 per cent. In large maternity centers it averages 6.2 per cent. Throughout the United States its incidence varies between 0.5 and 14 per cent.

2. The maternal mortality in the larger maternity centers approaches 1.0 per cent. The fetal mortality for the operation is between 7 and 8 per cent. Both maternal and infant mortality rates are greater than following vaginal delivery.

3. The rapidly increasing number of previously cesareanized women constitutes a major problem in future obstetric practice.

4. Factors tending to increase the incidence of the operation are: increased hospital facilities, increased safety afforded by the sulfonamides, the antibiotics, and blood replacement, improved technique, influence of the training centers, roentgen-ray pelvimetry, fetal salvage, and remuneration and convenience for the operator.

5. The indications for the operation reveal that cephalopelvic disproportion is the leader, closely followed by "repeat cesarean." In third place stands placenta previa. There has been an expansion of the use of the operation into the field of borderline or relative indications.

6. The operation has increased fetal salvage in diabetes and placenta previa. Among other complications the benefits have not been remarkable.

7. In spite of highly satisfactory results attending vaginal delivery for inertia, toxemia, abruptio placentae, and other temporary major complications, a varying proportion of such cases are still treated by cesarean section with less favorable results.

8. There is evidence that the proponents of cesarean section in the past are currently being converted into exponents of vaginal delivery for previously cesareanized women.

9. The immediate dangers and remote hazards of cesarean section are pointed out.

10. The qualifications of the obstetrician and his responsibilities are discussed.

11. A plea is made for better judgment regarding the employment of cesarean section without a test of labor in doubtful cases.

12. Common experience and documented evidence indicate that further widening of the indications for cesarean section is not justified.

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## BLOOD AND BLOOD VESSELS IN GYNECOLOGY AND OBSTETRICS\*†

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THE leading causes of maternal death are still hemorrhage, infection, and toxemia. Pulmonary embolism, anesthesia, and heart disease rank close to them as agents productive of a fatal issue. Despite antibiotics and blood transfusion, peritonitis and hemorrhage continue to be lethal, although it must be conceded that great strides have been made in lessening the frequency and severity of these complications. Coincident with the lowering of the number of fatalities resulting from hemorrhage and/or peritonitis, one finds pulmonary embolism an increasing factor as a cause of postoperative fatality. Each new therapeutic measure brings new complications, some minor, such as allergic reactions, and others major, such as lower nephron nephrosis. Thus, the advent of extensive surgical procedures and the increased utilization of blood transfusion in gynecology greatly augment the problems with which we must deal. As many maternal and gynecologic deaths are directly or indirectly concerned with the vascular tree and its contents, a survey of some of the problems is pertinent.

### Hemorrhage

In obstetrics, we are fairly certain of one eventuality, and that is the patient will ultimately bleed. This is true whether the pregnancy terminates as a cervical, intrauterine, tubal, ovarian, or abdominal gestation. Surely, grand multiparity, multiple pregnancy and/or polyhydramnios, placenta previa, abruptio placentae, uterine inertia, and operative deliveries are likely to be followed by postpartal hemorrhage, and preparation should be made for such a complication. However, all patients having these obstetric variations do not have postpartal hemorrhage, and, conversely, many patients who have had a perfectly normal pregnancy and delivery do have postpartal hemorrhage. Thus, all pregnant women are candidates for deaths by hemorrhage and we cannot foretell who will bleed a subnormal, normal, or abnormal amount, or when this will occur. Therefore, it is best that, once pregnancy is suspected, the patient have her blood group and Rh factor established, in order that should hemorrhage occur, blood transfusion can be more readily and quickly administered. If blood banks are not available in the vicinity, then typing of the patient's relatives and friends is important in order that a compatible donor be available when termination of the pregnancy occurs. A cross index of the patient's blood and Rh factors gives one a ready list of many potential donors. In obstetrics, the peculiar susceptibility of the pituitary gland, kidney cortex, and adrenal gland to hypoxia or anoxia is striking, and though

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many survive a marked hemorrhage they succumb in a few days or weeks to necrosis of the pituitary gland, or of the cortex of the adrenal or kidney.<sup>1-4</sup> Those who survive a minor degree of damage to the pituitary gland may be perfectly normal thereafter, or may develop a Simmonds' syndrome.

Needless to state, we usually have many months in which to prepare the patient for parturition and any deficiency in the blood count or hematocrit determination should be corrected by the administration of iron preparations or blood transfusion when necessary.

Patients with lowered blood volumes are more susceptible to infection than are those whose blood volumes are near normal; and antibiotics seem to produce better results in the presence of a normal blood volume than in anemic patients.<sup>5</sup> Some believe that toxemia of pregnancy is more prevalent in the anemic and undernourished patient.<sup>6, 7</sup> Furthermore, a normal blood volume seems to be more conducive to wound healing as it is believed that in the malnourished patient the first demand on ingested protein is to form hemoglobin at the expense of fibroblastic tissue.<sup>5</sup> It is readily apparent, then, that close attention to a pregnant patient's status as regards anemia should lead to a marked decrease in maternal deaths from hemorrhage, toxemia, or infection.

In gynecology the advent of more complete and extensive surgery for benign and malignant lesions has been made possible by better anesthesia and, more particularly, the availability and usage of blood transfusion. Recognition of the importance of careful attention to the preoperative administration of sufficient quantities of blood to correct any deficiency that might exist, and the administration of this substance during and following operation, where needed, allow for lowered morbidity and mortality.

McKelvey<sup>8</sup> has demonstrated the fact that patients with carcinoma of the cervix respond to radiation therapy more favorably if they are adequately treated for malnutrition and anemia prior to the institution of radiation therapy.

The marked lowering in the mortality rate from ectopic gestation on all Gynecologic Services at Charity Hospital has in a large part been due to the establishment of a blood bank, though other factors played equally important roles.<sup>9-12</sup>

In administering blood at the time of laparotomy it must be remembered that the veins of the legs and arms are not the only tributaries into which the substance may be introduced but that, in an emergency, more rapid and effective administration of blood may be accomplished by transfusion into the vena cava, aorta or iliac vessels, which vessels are so readily available.

While it is not the purpose of this communication to discuss surgical technique or technical errors committed at the time of surgery that might lead to postoperative hemorrhage, it might be pertinent to state that in radical pelvic surgery and radical pelvic gland dissection much less bleeding is encountered in dissecting the obturator fossae if the common and external iliac arteries and veins are separated from the psoas muscle, retracted medially, and the fossa attacked through this area, than if an attempt is made to approach the obturator fossa through the area between the external and internal iliac vessels. This approach to the obturator fossa allows for excellent exposure of the fossa and offers a better chance for more thorough clearing of the area. Furthermore, the utilization of silver clips on the deeper tributaries of the hypogastric vein rather than ligatures materially adds to the ease and safety of the procedure. Should unexpected bleeding occur, a pack can be introduced with ease and facility, pressure applied for a few minutes, the pack removed, and by aid of a suction apparatus the bleeding point identified. In this manner damage to other structures is avoided. We never perform any

operation unless a suction apparatus is set up, for, when unexpected bleeding occurs, sponging alone is insufficient to clear the area, while by means of suction the bleeding point is found, kept clear of blood, and only the bleeding vessel clamped.

Extensive dissection about major vessels supplying an extremity usually results in vasospasm of the whole vascular tree of the extremity. Therefore, it has been our practice when pelvic lymphadenectomy has been performed to inject each lumbar sympathetic area with Novocain before closing the abdomen. This is performed with two thoughts in mind, namely, to reduce the chance of postoperative intravascular clotting and also to try to improve the blood supply to the ureters. Perhaps in this manner the incidence of ureteral fistulas occurring following radical hysterectomy and radical pelvic gland dissection might be avoided. It is too early for us to assay properly the value of this procedure in our series of cases of radical pelvic surgery.

Though blood has been responsible for the saving of many lives, it should be used judiciously. Lower nephron nephrosis from reactions due to incompatibility is not infrequent. This clinical entity also results from shock from hemorrhage. It is our policy to give blood in cases of shock until the patient recovers from shock and if signs of kidney damage appear no more blood is utilized. Once signs and symptoms of impaired kidney function develop, fluid intake per 24 hours is limited to 1,000 c.c. of glucose intravenously plus an amount of the same electrolyte equal to the previous 24 hour urinary output. Sodium chloride is not administered until the period of diuresis occurs, which is usually anywhere from 5 to 15 days following the onset of the nephrosis. It is during this period that salt depletion may occur. Electrocardiograms are taken every other day until diuresis ensues. If any evidence of hypokalemia is found, sodium potassium glucose solution is administered. We have not seen hyperkalemia develop in any of our cases. If it should develop, the administration of K is discontinued and sodium chloride substituted. Whenever feasible, potassium is best administered orally. Under this regimen most of our patients with lower nephron nephrosis have survived.

### Blood Vessels

As previously stated, pulmonary embolism is a frequent cause of death occurring in gynecologic and obstetric patients. During the period Jan. 1, 1949, to Jan. 1, 1952, there have been 12,095 deliveries on the Tulane Unit, Charity Hospital. There were 16 maternal deaths during that period (Table I).

TABLE I. TULANE UNIT, CHARITY HOSPITAL, JAN. 1, 1949, TO JAN. 1, 1952

Total deliveries	12,095
Maternal deaths	16
Mortality, 1.4 per 1,000 deliveries	

TABLE II. TULANE UNIT, CHARITY HOSPITAL, JAN. 1, 1949, TO JAN. 1, 1952. CAUSES OF MATERNAL DEATH—EMBOLISM

Amniotic fluid embolism	3
Air embolism	1
Embolism from phlebothrombosis	2

Approximately one-third of the deaths were attributed to some type of pulmonary embolism (Table II). Hemorrhage or blood transfusion accounted for another third of the fatalities (Table III). In Table IV the remaining causes of death in this series are listed. Women, pregnant or not, are susceptible

to more varied causes of embolism than men. Embolism from phlebothrombosis, thrombophlebitis, suppurative pelvic thrombophlebitis, air, oil, fat, bone marrow, or amniotic fluid may be her lot.

### Phlebothrombosis

By phlebothrombosis is meant a bland, loosely attached or nonadherent clot arising within a vein lumen. By its very nature, that is, being friable and loosely attached, resulting pulmonary embolism is frequent and often fatal. Unfortunately, the signs and symptoms of this entity are few. Therefore daily examination of the legs of all patients confined to bed is essential. The examination should consist of palpation of the calf, popliteal and femoral areas. Dorsiflexion of the foot on the leg (Homan's sign) in an attempt to elicit pain completes the examination. In phlebothrombosis, fever is rarely present. If present, the temperature is elevated only a few fifths of a degree. However, an unexplained rise in the pulse rate is usually noted. Many times a small pulmonary infarct precedes the large fatal embolus by a few hours. When we believe phlebothrombosis of the leg veins exists, bilateral superficial femoral vein ligation is performed. If the clotting process is found to extend higher than the common femoral vein, vena cava ligation is done. In two of our patients, when this existed and the clot was removed by suction and the superficial femoral veins ligated, the patients succumbed a few days later to fatal pulmonary embolism, evidently due to reformation of the clot above the point of ligation.

Many use anticoagulants in the therapy of this complication with good results. The question as to which is the best, ligation or anticoagulants, has not been settled. The important point is that this complication must be constantly searched for in any patient confined to bed, and once its presence is suspected or confirmed, therapy instituted whether that therapy be anticoagulants, surgery, or both. Patients susceptible to intravenous clotting are susceptible to recurrent episodes each time they are confined to bed. Whether or not the patient has had an episode of intravascular clotting in a previous bed confinement should be recorded as a part of every gynecologic or obstetric history. Early ambulation and active leg motion in bed have reduced but not eliminated this complication. Other prophylactic measures have been described elsewhere.<sup>13</sup> On our service antepartal or postpartal phlebothrombosis is treated by vein ligation. Under this plan of constantly searching for this disease and the prompt application of therapy described, the incidence of fatal pulmonary emboli has greatly decreased.<sup>14</sup>

TABLE III. TULANE UNIT, CHARITY HOSPITAL, JAN. 1, 1949, TO JAN. 1, 1952. CAUSES OF MATERNAL DEATH—HEMORRHAGE

Irreversible shock on admission	2
Lower nephron (abruptio)	1
Pituitary necrosis	1
Transfusion reaction	
Lower nephron nephrosis	1

TABLE IV. TULANE UNIT, CHARITY HOSPITAL. JAN. 1, 1949, TO JAN. 1, 1952. CAUSES OF MATERNAL DEATH

<i>Toxemia.</i> —	
Eclampsia	2
Cerebral hemorrhage	1
<i>Anesthesia.</i> —	
Aspiration	1
<i>Other.</i> —	
Self-ingested poison	1

**Thrombophlebitis (Phlegmasia Alba Dolens)**

In this clinical entity the clot is infected and firmly adherent to the vein wall. The clot is, however, rarely if ever suppurative in nature. The patient usually calls the physician's attention to the complication by complaining of a swollen painful leg. This is unlike phlebothrombosis, where few if any symptoms exist and the physician must seek out its presence. In phlegmasia alba dolens the leg is swollen, edematous, and tender; and the patient's pulse and temperature are elevated. The latter may be as high as 102° or 103° F. In this condition we have been uniformly successful in having good results by employing lumbar sympathetic blocks. The relief from pain is dramatic and in a few hours the edema begins to diminish. We believe that lumbar sympathetic block is superior to any other form of therapy dealing with this complication.<sup>15</sup>

**Suppurative Pelvic Thrombophlebitis**

The process of septic thrombosis in the pelvic veins is a distinct type of intravascular clotting which has been termed "suppurative pelvic thrombophlebitis." It can occur independent of leg vein thrombosis and death does not result from sudden massive pulmonary embolism as is seen in phlebothrombosis but rather from repeated small septic emboli with resulting septicemia and seeding of small abscesses in distant organs. Sulfonamides and antibiotics have served to reduce the incidence and severity of pelvic sepsis but our experience with many cases of pelvic sepsis over a period of twenty-four years has demonstrated to our satisfaction that all cases of postabortal or postpartal sepsis will not respond to medical regimen including sulfonamides, antibiotics, anticoagulants, and blood transfusion. Patients who fail to respond to such a medical regimen in four to six days, or who develop a pulmonary embolus while under medical therapy, or who are admitted to our service with an already existent pulmonary infarct are subjected to operation. The operation consists of ligation of the normal venous return from the uterus, i.e., both right and left ovarian vessels and the inferior vena cava. In previous communications<sup>16-19</sup> we have in detail described the incidence, pathology, etiology, symptomatology, and diagnosis of suppurative pelvic thrombophlebitis as seen on our services. In addition, the surgical technique involved and follow-up studies have been recorded. Briefly, the entity can follow any type of term delivery, is frequently seen following induced abortion, may develop following any type of pelvic surgery, and is sometimes associated with pelvic or tubovarian abscess. It is characterized by high pulse rate, often out of proportion to the patient's temperature, and is usually associated with chills and spiking fever. Thrombosed veins in the genital tract can be frequently palpated. Pulmonary infarction as detected by physical sign or x-ray is usually present.

Since 1941 we have found it necessary to employ surgery in 86 such cases with salvage of 76 cases, or 88 per cent. It is to be remembered that surgery was utilized only in those patients who failed to respond in a reasonable period of time. We believe that this procedure has undoubtedly saved many lives that otherwise would have been lost. Of interest is the fact that despite the introduction of anticoagulants, sulfonamides, and antibiotics, our indication for surgery remains the same as it did in 1941.

**Phlegmasia Cerulea Dolens (Acute Massive Venous Occlusion of the Lower Extremities)**

In venous thrombosis of the lower extremities the blood flow may be so impeded by massive venous thrombosis and vasospasm that gangrene of the toes and feet may result. Furthermore, life as well as limb may be endangered. DeBakey and Ochsner<sup>20</sup> in 1949 were able to collect only 56 cases from the

recent medical literature, while Veal<sup>21</sup> in 1951 reported 11 cases of his own. Veal states that though there has been a paucity of reports, indicating that the condition is rare, he believes that many more cases occur than are reported. In two of Veal's eleven cases the condition developed post partum. We have encountered one case of phlegmasia cerulea dolens on our gynecologic service during the past few years. The patient died as a result of this condition, though the diagnosis was established when the condition first developed. We have not observed any such case on our obstetric service. The manifestations of this clinical entity are marked venous congestion, rapid swelling of the limb, cyanosis, and excruciating pain. Veal has found that methods directed at relieving vasospasm such as lumbar sympathetic blocks, lumber sympathetic nerve section, and/or the administration of vasodilator drugs are of little value. Lumbar sympathetic block and vasodilator drugs failed in our only case. Veal did achieve excellent results by elevating the involved extremity to a 60 or 75 degree angle and then flexing and extending the foot rapidly. At the same time flexion and extension of the thigh were accomplished. By these maneuvers the pain subsided rapidly, the cyanosis disappeared gradually, and the skin temperature became elevated. The exercises were continued with short intervals of rest until the limb could be allowed to remain at a high level on pillows without venous engorgement returning. In one of the cases reported by DeBakey, removal of a thrombus from the femoral vein proved efficient.

#### **Amniotic Fluid Embolism**

The presence of amniotic fluid and meconium in the pulmonary circulation was first described by Steiner and Lushbaugh<sup>22</sup> in 1941. It is the opinion of these authors that this phenomenon is the most common cause of maternal death occurring during labor or the immediate puerperium. Since this original article numerous subsequent cases have been added to the literature. On the Tulane Service at Charity Hospital of Louisiana in New Orleans there have been three such cases during the years 1950 and 1951.

The outstanding clinical feature described is shock occurring during labor or immediately after. This has variously been attributed to many clinical entities all of which were proved to be either only partially responsible or completely nonexistent; namely, rupture of the uterus, hemorrhage, abruptio placentae, acute ventricular failure, toxemia, anesthetic accidents, and obstetrical shock. However, these investigators<sup>22</sup> and those who have since contributed to the literature have repeatedly been able to demonstrate the pathology of amniotic emboli both grossly and microscopically. The gross evidence may be noted in the lungs where one can frequently express meconium and lanugo hair from the cut surface of the organ. The microscopic picture shows clearly the presence of keratinized squamous cells, granular acidophilic substance, mucin, and lanugo hairs within the arteries, veins, arterioles, and venules of several organs, namely, the lungs, uterus, and ovaries.

In a study made at Charity Hospital of the maternal deaths on the Tulane Service from 1940 to 1950, there was not a case reported of this clinical entity.<sup>23</sup> It is our belief that death from amniotic fluid and meconium emboli is a more frequent cause of sudden demise at the time of labor than is suspected. During the past two years the residents and pathologists have been stimulated to look for these findings both at the autopsy table and at microscopic examination of tissue removed.

If autopsy has been refused, aspiration of blood from the ventricles of the heart should be performed. The aspirated blood should be studied according to the method of Gross and Benz<sup>24</sup> for the presence or absence of amniotic fluid emboli. Of the three cases seen on our service since 1950, two were proved by autopsy and one by the method of Gross and Benz.

As a result of this diligence, we are able to report three cases from the Tulane Unit, Charity Hospital, in 1950, which came to autopsy, and two in 1951, one that came to necropsy and one in which fluid was smeared from the ventricle immediately post mortem and showed evidence of material from the uterine cavity.

### Air Embolism

Air embolism may be defined as the result of the entrance of air into the venous or arterial circulation, with consequent blockage of the heart and pulmonary circulation or occlusion to varying degrees of the arterial vessels, most significantly the cerebral and coronary branches. Rarely, air gaining its entrance through the venous system may follow a "paradoxical route" through a septal cardiac defect and result in arterial blockage. It is thought that the venous portal is the more common and of more serious consequence. The end results of arterial occlusion depend upon the size and location of the vessel and the vital or nonvital area it supplies.

There is general agreement that air embolism in sublethal dosages occurs much more frequently than is suspected and it is also thought that fatal episodes have gone undiagnosed and other conditions have been blamed for the patient's death.

Categorically, we may classify air embolism as to mode of occurrence, and as to the predisposing factors allowing for the entrance of air in clinically significant amounts. In consideration of these factors one may subdivide air emboli as they occur in pregnancy and the puerperium, during surgery, in trauma, in carrying out diagnostic procedures, and in applying therapeutic measures.

In pregnancy and the puerperium the basic opportunity for entrance of air into the venous system is offered by distended sinuses of the uterine bed from which the placenta has been either partially or completely detached. Air embolism has been known to occur during early pregnancy when attempts were made to induce criminal abortion by introduction of air or solutions under pressure into the uterine cavity<sup>25</sup>; while using douche medications under pressure<sup>27</sup>; and in premature separation of the placenta with uterine contractions acting as the agent to produce the increased force. It has also been reported as occurring during cesarean section, during hysterectomy, during insufflation of the vagina with powders, and during knee-chest exercises in the early puerperium.<sup>26</sup>

Air embolism while diagnostic procedures are being carried out has been known to occur during tubal insufflation for patency tests<sup>28</sup>; during inflation of the urinary bladder; in perirenal air insufflation for adrenal visualization; in diagnostic dilatation and curettage of the uterus; and in one instance it complicated peritoneoscopy. It appears, therefore, that injection of air into the pelvic organs or into the retroperitoneal, or peritoneal spaces, while a valuable adjunct to the armamentarium of diagnostic studies, is not without danger.

Therapeutically, air embolism has been noted as a complication of pneumoperitoneum, vaginal insufflation, therapeutic dilatation and curettage of the uterus, and during the intravenous administration of fluids and blood.

As to the pathology of this condition, there seems to be no agreement regarding the amounts of air necessary to produce fatal results. Tolerance in human beings appears to vary, as well as other factors, such as the rapidity with which the air enters the circulation, and also the general condition of the subject. Animal experimentation has been helpful but not directly transferable to man in mathematical proportions.

The mechanism of death in the venous type of air embolism is thought to be one or a combination of three methods: mechanical interference with

heart function due to the presence in the right auricle and ventricle of large amounts of air which is expansive during diastole and somewhat compressible during systole producing a blood "froth," the patient expiring due to cardiac arrest, blockage of the pulmonary artery by this air and "froth," with arrest of the circulation in the lung, and multiple smaller air emboli choking the finer arterioles in the lung.

In the venous type of air embolism the signs and symptoms are usually sudden and dramatic. The patient becomes dyspneic, cyanosis is apparent, the pulse becomes very rapid, irregular, then imperceptible, blood pressure becomes unobtainable, and if the patient is not anesthetized he complains of retrosternal pain, displays air hunger, is restless and frantic appearing, and seems to sense impending disaster. On auscultation of the heart one may hear a peculiar rushing, gurgling sound caused by the admixture of air and blood.

In the arterial type, the signs and symptoms are what might be expected from the pathology, either those of focal neurological changes or those of coronary occlusion.

Inasmuch as treatment is ineffective unless rapidly carried out, the condition must always be borne in mind in patients in sudden distress under circumstances predisposing to air emboli. Methods recommended in the therapy of this condition hinge largely on the removal of the air from the right ventricle. This is done by aspiration either at the tip of the xiphoid or in the fifth right interspace. This may be performed immediately. Other measures such as turning the patient on his left side to allow the air to rise above the level of the blood, forced oxygen, antispasmodics such as papaverine and atropine, administration of blood and fluids intravenously, and similar supportive measures may be done but usually are of no value.

It must be emphasized that in patients dying with suspected air embolism, autopsy should be sought, but, if unobtainable, one should still aspirate the right ventricle in an effort to establish the presence or absence of air or foam.

The one case of air embolism occurring on our service since 1950 followed manual removal of the placenta.

#### Bone Marrow Embolism

Rappaport and his co-workers<sup>29</sup> in 1951 studied 292 postconvulsive deaths. This study included deaths from trauma with multiple fractures, accidental electrocution, generalized convulsions, eclampsia, tetanus, and fatal termination from Metrazol or electric shock therapy. As controls, 240 cases of death without convulsions or trauma were studied. No evidence of bone marrow embolism was found in the latter group, whereas in 20 cases of the former group bone marrow emboli were found. In 35 cases of convulsive toxemia of pregnancy autopsied, bone marrow emboli were found in one case. However, in none of the 20 cases of bone marrow emboli encountered could the cause of death be attributed to bone marrow emboli. We have not observed or detected any case of bone marrow emboli on our service.

#### Oil Embolism

Death from oil embolism in gynecology is a rare occurrence. According to Karshner and Stein,<sup>30</sup> only one fatality from this cause following hysterosalpingography has been reported, but death from oil embolism following attempted criminal abortion occurs.<sup>31</sup> However, the introduction of radiopaque oil into the cervical, uterine, or tubal veins is an accident which, fortunately, is not often serious. In those cases which have resulted in pulmonary complications, the severity has varied from mild respiratory distress to pneumonitis with pleural effusion. Since death, while admittedly extremely un-

common, is a possibility, it behooves the physician to exercise certain precautions.

The amount of oil and the pressure with which it is injected are important factors. The fractional method of introducing small amounts (2 c.c.) at a time and immediately developing the x-ray is safer than introducing the entire amount at one time. In this latter case, all of the drug may find its way into the vascular system. Pressure should be under manometric control and should not rise above 200 mm. of mercury. Care should be exercised in introducing the cannula into the cervix in order to prevent damage to the epithelium. Hysterosalpingography should not be used during menstruation, immediately following cessation of the flow, or too early in the puerperium because at that time the vessels of the basal layer of the endometrium are less protected and access to them could be accomplished with very low pressure. For the same reason, the endometrium should be allowed to regenerate following endometrial biopsy or dilatation and curettage before air, oil, or water-soluble materials are injected into the endometrial cavity. Oil embolism has not been observed by us.

#### Fat Embolism

While fat embolism seems to occur most frequently in closed fractures and in enucleation of the eye, it also occurs in surgical trauma. Dunphy and Ilfeld<sup>32</sup> have listed three conditions that must be present in order that fat embolism might occur: free liquid fat in the tissues; torn and patent veins; increased local pressure above the level of the venous pressure. It can be seen readily that pelvic surgery could, but would not be likely to, furnish these conditions, and fat embolism has not been observed on our service, or we have failed to recognize it.

The manifestations of fat embolism are mainly pulmonary and cerebral. The symptoms of the former are increased respiratory rate, fever, severe pulmonary edema, dyspnea, cyanosis, and frothy sputum, while those of the latter vary from confusion and mild psychosis to convulsions and coma.

The diagnosis can be established by x-ray, in which there is a diffuse cloudiness of both lung fields twenty-four to forty-eight hours after the episode, or by laboratory tests on urine or sputum. It should be remembered that only the last drops of urine should be stained because fat is lighter than urine.

The treatment is largely dependent on positive pressure oxygen therapy. Antibiotics should also be given and blood administered if indicated. The prognosis depends upon the amount of fat that has entered the circulation.

Treatment is dependent upon the severity of the symptoms. If the pulmonary complication results in hypoxia, oxygen should be administered. Antibiotics, of course, are indicated.

#### Comment

Obviously, space does not allow for a complete discussion of blood and blood vessels in gynecology and obstetrics. The role played by blood dyscrasias, afibrinogenopenia, and many other conditions has not been touched upon. We have attempted to show the necessity of preparing for the bleeding that is inevitable in any pregnancy and which may reach alarming proportions. The value of, and sometimes ill effects of, blood transfusion in many conditions was emphasized. The major role of embolism in maternal mortality is real. The many forms of embolism to which pregnant and nonpregnant women are susceptible have been reviewed. It is emphasized that only by

constant search at autopsy, or by the use of aspiration of the ventricles of the heart in cases where autopsy is not granted, can cases of amniotic fluid or air embolism be detected. Embolism from phlebothrombosis, thrombophlebitis, or suppurative pelvic thrombophlebitis can be effectively managed by vein ligation or anticoagulants or both. Fat, oil, and bone marrow emboli are best treated by avoiding morphine and its derivatives and the use of papaverine, atropine, oxygen, and antibiotics. In addition to these methods fibrin may be of aid in amniotic fluid embolism.

It should not be forgotten that tracheotomy will allow for better oxygenation of blood in cases where secretions collect in the upper part of the tracheobronchial tree and may be lifesaving in eclampsia or aspiration of vomitus at the time of anesthesia. This is mentioned as this procedure has been a valuable therapeutic aid on our services though this presentation is not concerned with the oxygen-carrying power of the blood or methods of oxygenating blood. Obstetrics and gynecology are specialties where surgery is utilized and the importance of blood and blood vessels is paramount.

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## **PROGESTERONE AND VITAMIN K\* FOR THE PREVENTION OF ERYTHROBLASTOSIS FETALIS†**

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**E**RYTHROBLASTOSIS fetalis has received much attention since Landsteiner and Wiener isolated the Rh factor in 1940 and Levine (1939), Katzin, and Burnham demonstrated that its transmission through the placental barrier caused erythroblastosis fetalis, as well as many other unexplained transfusion reactions. Many reports have been issued giving promise and discouragement relative to infant prognosis.

Approximately 15 per cent of all white people have been found to be Rh negative.

Thirteen per cent of all marriages will constitute incompatible matings with the wife Rh negative and the husband Rh positive.

Erythroblastosis occurs once in every 200 full-term pregnancies of all matings and in only 1 in 26 full-term pregnancies of the 13 per cent incompatible matings. The latter usually have one or two normal infants before an erythroblastotic one.

### **The Mechanism of Transplacental Immunization**

Levine assumed that the thinning of the placental barrier plus the relatively higher pressure of the fetal circulation over the maternal sinus pressure allowed the fetal red cells to enter the maternal system. Haldane believes the abnormal permeability of the placenta to fetal antigen is genetically determined. Vitamin C deficiency, even subclinical, gives increased capillary permeability (Burnham). Javert described gross hematoma in eight fatal cases of erythroblastosis. Kline reported a series of fatal cases in which there was occlusion of the peripheral placental vessels by agglutinated cells and fibrin with necrosis of walls, rupture, and hemorrhage into regional intervillous spaces with direct mixture of maternal and fetal blood. In older hemorrhages the bleeding had been stopped by fetal blood clotting at the site. There were vascular thromboses with necrosis and rupture of peripheral tissues in villi and trunks in fatal erythroblastosis. However, it is also noted in some degree in all cases of nonfatal erythroblastosis.

### **The Factors Influencing Sensitization**

1. The amount of antigen gaining access over a nine-month period may be an insufficient stimulus to stimulate the production of antibodies.

\*Medication used was Pranone (Schering Corporation, Bloomfield, N. J.), and Hykinone (Abbott Laboratories, North Chicago, Ill.), all of which was generously supplied by these companies.

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2. The Rh agglutinogen may not acquire antigenic potency until late in pregnancy. The first massive maternal transfusion with fetal red cells usually occurs with the trauma of delivery. The first titer is found frequently two weeks post partum.

3. A greater number of pregnancies affords more likelihood of sensitization to the antigen. Thus, the modern small family lowers the danger.

4. Some Rh subtypes possess low antigenicity. One or two transfusions may not cause antibodies in some.

5. The fetal cells may not be affected by maternal agglutinins.

6. The mother may not form antibodies.

7. Antibodies may not pass back through the placenta to the fetus.

### Prognosis

Prior to the discovery of the Rh factor, 40 per cent of infants with erythroblastosis died.

With transfusion of Rh-negative blood, the mortality dropped to 20 per cent. Exchange or replacement transfusions further lowered this to 5 to 10 per cent.

Levine reports that a history of prior transfusion doubles the fetal death rate with the abortion rate two or three times greater. The abortion rate in the nonsensitized woman is unchanged. Some say it is not affected even in sensitized women.

Once a woman has delivered a fatally erythroblastic infant, she is unlikely to deliver a less diseased one. She is even less likely to do so if she has been sensitized by both pregnancy and transfusion. Browne feels that once sensitized, the patient remains so. Future prognosis of progeny would then depend upon whether the husband is homozygous or heterozygous. This is not necessarily so since we have seen normal babies with homozygous fathers.

The Rh factor is the causative agent in only 90 to 95 per cent of cases of erythroblastosis fetalis.

The level of antibodies in maternal blood is not always a reliable prognosticator. High maternal antibody titer does not necessarily represent clinical erythroblastosis; however, prolonged high titer lowers the prognosis for the fetus.

The presence of antibodies is not always indicative of an Rh-positive infant; anamnestic reactions do occur.

### Methods to Reduce Fetal Mortality

1. Induction of labor prematurely at the thirty-eighth week is the preferable time since kernicterus before 38 weeks is four times higher than after. The incidence of atelectasis is also higher, as well as other unfavorable aspects of prematurity.

2. Elective cesarean section has largely been discontinued. Wiener reports 50 per cent mortality from cesarean sections, others are less sanguine.

3. Multiple transfusions of Rh-negative blood early in neonatal life, repeated as indicated by red blood count, lowered mortality to 20 per cent.

4. Replacement or exchange transfusions of Rh-negative blood, preferably female, has not only lowered the death rate but has markedly lowered the incidence of neurological stigmas.

5. Transfusion with 50 to 120 c.c. of sedimented red cells lowered the death rate to 10 per cent. The blood of adults has a high conglutinin titer while that of newborn infants has a low one; thus, whole blood might enhance in vivo hemolysis in infants.

TABLE I

CASE	GRAVIDITY	PAST HISTORY	DURATION TREATMENT	TREATMENT INITIAL TITER	HIGHEST TITER	POST- PARTUM TITER	CHANGE UNDER TREATMENT		END RESULTS IN CHILDREN
101	ii	1 normal child	1 month	1:2	1:128	1:32	Increase 4 dilutions	I.G.S.* R.T.,† lived	
102	i	2 Rh positive transfusions 9 years ago	6½ months	1:2	1:64	1:64	Increase 5 dilutions	I.G.M.,‡ R.T., lived	
103	v	3 normal children, 1 erythroblastotic and kernicteric	2 months	1:16	1:256	1:256	Increase 4 dilutions	I.G.S., R.T., died	
104	iii	2 normal children	3½ months	1:4	1:32	1:32	Increase 3 dilutions	I.G.M., R.T., lived	
105	iv	2 normal children, 1 erythroblastotic (lived)	2 months	1:1	1:116	1:16	Increase 4 dilutions	Spontaneous abortion at 4 months	
107	iii	1 stillborn child, 1 normal	2 weeks	1:32	1:32	1:32	None	I.G. Mod.,§ R.T., lived	
111	ii	1 normal child	5 weeks	1:8	1:16	1:4	Decrease 1 dilution	I.G.M., R.T., lived	
112	iii	1 normal child, 1 spontaneous abortion	3½ months	0	1:2	0	First titer at 7 months. Pos. trypsin at 5 months	Normal infant, Rh positive	
131	iii	1 normal child, 1 trans-fusion, 1 stillborn child	2 months	1:256	1:512	1:64	Decrease 2 dilutions	Normal infant, Rh negative, lived	
132	vii	2 normal children, 3 abortions, 1 stillborn child	2½ months	1:128	1:256	1:256	Increase 1 dilution, anamnestic	Normal infant, Rh negative, died—hyaline membrane	
137	ii	1 normal child	3 months	0	1:1	1:1	Anamnestic (¶) 1st titer 37th week	Normal infant, Rh negative, lived	
138	ii	1 normal child	2½ months	1:2	1:2	0	Disappeared	Normal infant, Rh positive, lived	

141	v	4 normal children	2 months	1:4	1:6	1:2	Decrease 1 dilution	I.G. Mod., transfu-												
148	iii	1 normal child, 1 still-born	6 months	1:128	1:128	1:32	Decrease 2 dilutions	Petal hydrops, still-born 7½ months												
149	ii	1 erythroblastotic child	3 months	1:2,048	1:2,048	1:1,024	Decrease 1 dilution	Spontaneous abortion, 3½ months												
E. B. P.	iv	2 normal children, 1 erythroblastotic—lived	3½ months	1:1	1:2	0	Disappeared	Normal infant, Rh negative, lived												
113	ii	Induced abortion, 4 months	3 months	1:256	1:800	1:800	Increase 1½ dilutions	Stillborn, fetal hydrops, 6½ months												
115	iii	1 normal child, 1 erythroblastotic—lived	2 months	1:64	1:64	1:64	None	I.G.S., R.T., lived												
120	iv	2 normal children, 1 erythroblastotic—lived	3½ months	1:8	1:32	1:32	Increase 2 dilutions	I.G. Mod., R.T., lived												
122	ii	1 normal child	4 months	1:8	1:16	1:4	Decrease 1 dilution	I.G. Mod., transfusions at 2 and 4 weeks, lived												
124	iii	2 normal children	3½ months	1:8	1:32	1:4	Decrease 1 dilution	I.G.S., R.T., died												
125	ii	1 normal child	4 months	0	1:4	1:4	1st titer 1:1, 7 months dose	Normal infant, Rh positive, lived												
128	iii	1 stillborn child, 1 erythroblastotic—lived	7½ months	1:4	1:4	1:1	Increase 2 dilutions	Normal infant, Rh positive, lived												
C. R. A.	iv	1 normal child, 1 still-born, 1 erythroblastotic—died	9 days	1:16	1:16	1:16	None	Abruptio 6½ months, stillborn, no erythroblastosis												

\*I.G.S.—Icterus gravis severe.

†R.T.—Replacement transfusion.

‡I.G.M.—Icterus gravis mild.

§I.G. Mod.—Icterus gravis moderate.

6. Kariher used antihistamines prenatally without effect.

7. Moloney injected ethylene disulfonate, 2 c.c., antenatally, weekly, with no results.

8. Wiener utilized the competition of antigen theory (antibodies are stimulated against stronger antigen and not against weaker), when he injected typhoid vaccine into Rh-negative pregnant women without effect.

9. Carter advocated Rh haptens in which haptens would neutralize antibodies. Results were so questionable that this has been largely discontinued.

10. East and Mair utilized intravenous immunization with paternal blood followed with intramuscular blood during pregnancy. One case showed high titers; the baby lived with mild erythroblastosis.

11. Hoffman and Edwards, in an attempt to prevent rather than treat the condition, tried to prevent transfer of fetal antigen through the placenta. They utilized progesterone to decrease contractility and improve placental base and vitamin K to diminish fragility of capillaries of the placenta. Their preliminary report served as the basis for this investigation.

### Material

The patients studied include 128 untreated patients used as controls, and 24 treated patients. All patients had positive albumin antibody titers and either aborted or delivered.

A second series of 79 patients were placed upon prophylactic treatment and all have been delivered.

Those listed as treated were placed into two groups. Prophylactic cases were given 10 mg. of anhydrohydroxyprogesterone (Pranone), sublingually, daily, and 5 mg. of vitamin K (Hykinone), orally, twice weekly. The sensitized group received 50 mg. of Pranone, sublingually, daily, and 10 mg. Hykinone, orally, four times weekly.

The average period of treatment for those with positive titers was three and one-half months, while those on prophylactic therapy received medication for four months plus.

All laboratory tests for antibodies, blocking, and agglutinating titers were performed at the Crawford W. Long Memorial Hospital Blood Bank.

All prophylactically treated patients were on the clinic service of the Crawford W. Long Memorial Hospital (40) and private cases of one of the authors (C. S. G.) (39). Cases with positive antibodies included all known cases tested at the Crawford W. Long Blood Bank from Jan. 23, 1948, until Jan. 4, 1952. Treated positive cases were delivered from January, 1951, until January, 1952.

Table I lists cases by number, with gravidity, past history, duration of treatment, antibody titers on initiation of therapy, as well as maximal and post-partum titers, with change under therapy by tubes of dilution and the end results.

Case 112 was included in both series since the patient had a positive trypsin for several weeks prior to initiating prophylactic treatment, which was begun two weeks before the first positive antibody titer was reported. She then received the usually higher dosages.

Hoffman and Edwards had no treated patients who delivered erythroblastic infants. In our series there were four normal babies and the remainder of the Rh-positive babies had erythroblastosis fetalis of varying degree, with two stillbirths and one neonatal death from erythroblastosis. Nine babies received replacement transfusions, one dying.

The titer changes did not agree with Hoffman and Edwards' series since the titer disappeared in 2 and showed no change in 4. However, there were in-

creases of 1 to 2 dilutions in 4 cases and increases of 3 to 5 dilutions in 6 cases, while 8 cases demonstrated a decrease of 1 to 2 dilutions. Many feel that variation of 1 to 2 dilutions is not significant. However, it might be noted that in the 128 untreated cases 8 cases had a decrease of 1 to 2 dilutions, while all others remained stationary or increased.

Case 149 had a 1:9600 titer with the first pregnancy, terminating as a severe erythroblastotic neonatal death. At the beginning of the second pregnancy, the titer dropped from 1:2048 to 1:1024. The pregnancy terminated as a spontaneous abortion at 3½ months without autopsy.

Table II presents uncorrected and corrected statistical studies of treated cases while Table III shows corrected and uncorrected statistics of untreated cases with explanatory remarks.

TABLE II. SENSITIZED WOMEN TREATED WITH PROGESTERONE AND VITAMIN K\*

	CORRECTED	UNCORRECTED
Number of sensitized women	19	24
Number of abortions	2	2
Number of stillbirths	2	3
Number of neonatal deaths	2	3
Number of living infants	13 (68.4%)	16 (66.6%)
Average duration of treatment		3½ months
Infants receiving replacement transfusions		9
Number of neonatal deaths		1 (11.1%)

\*To obtain fetal salvage figures, all cases of Rh-negative infants and all cases of Rh-positive infants dying of causes other than erythroblastosis are omitted from the corrected statistics.

TABLE III. SENSITIZED WOMEN NOT TREATED WITH PROGESTERONE AND VITAMIN K

	CORRECTED	UNCORRECTED
Number of sensitized women	122	128
Number of abortions	2	2
Number of stillbirths	10	11
Number of neonatal deaths	14	14
Number of living infants	96 (78.7%)	101 (78.9%)
Number of normal infants		16
Number of infants receiving replacement transfusions		36
Number of neonatal deaths		2 (5.6%)

In the untreated cases there were 16 normal babies with Rh-positive blood, yet positive maternal antibody titers.

The results in treated and untreated cases are statistically similar and there is no evident beneficial effect from progesterone and vitamin K in the dosages and routes administered in this study once the placental barrier has been breached.

Patient 128 was thought to have been benefited by treatment (private physician's opinion) and is pregnant again. She has a negative titer and is resuming therapy.

It is also our opinion that it is doubtful, in view of placental pathological findings in affected cases, that drugs can be of much value in healing necrotic placental tissues, counteracting agglutination and thromboses or stopping intermingling of fetal and maternal blood. Therapy to be effective must be instituted in time to prevent this breakthrough. We agree with Schneider and associates, that therapeutic measures such as exchange transfusions, are beneficial, but the ultimate goal is to prevent this sensitization from occurring.

The presence of antibodies need not mean sensitization from current pregnancy. Isoagglutinins in the mother need not sensitize the baby.

Measures to prevent or curtail breakthrough should be of value. To give optimal chance of protection, any therapy should be started as soon as possible and continued until delivery. Therapy started after current sensitization and utilized for a few weeks or months is of questionable value, but longer use may warrant further consideration, especially with larger doses.

Accordingly, 79 patients of incompatible matings, without titers, were placed upon a prophylactic regime with results shown in Table IV.

TABLE IV. PROPHYLACTIC TREATMENT WITH PROGESTERONE AND VITAMIN K\*

	CORRECTED	UNCORRECTED
Number treated	78	79†‡
Number of abortions	0	0
Number of stillbirths	0	1
Number of neonatal deaths	0	0
Number of children living	78 (100%)	78 (98.7%)

\*Fathers tested: homozygous—37.5 per cent, heterozygous—62.5 per cent.

†Clinic patients—40, private patients (C. S. G.)—39.

‡Gravida i—30, gravida ii—21, gravida iii—19, gravida iv—7, gravida v—1, gravida vi—1.

There were 30 gravida i patients, 21 gravida ii, 18 gravida iii, 7 gravida iv, and 1 each of gravida v and vi. It is admitted that each group, or gravidity, is too small to be of true statistical value, but under the normal expectancy of 1 case of erythroblastosis fetalis in 26 full-term pregnancies, there should have been three cases of erythroblastosis fetalis, while none were noted. This is suggestive as being of value. Approximately 50 more cases are being followed, undelivered, with no titers to date. It is felt that our series has about an average spread of gravidity.

Absence of abortions is not necessarily significant since most could have occurred prior to the beginning of therapy. However, progesterone is advocated as prophylaxis by some.

We doubt that therapy neutralizes any antibodies. If it decreases the amount of fetal and maternal blood intermingling, by curtailment of new breaks, it should aid prognosis of this and subsequent pregnancies.

Table V lists the three groups of cases in which any history of prior sensitization as the result of transfusions (other than Rh-negative blood) and prior erythroblastosis was known. History of abortions was not included unless known to be induced. These data indicate therapy was of no value when prior sensitization existed.

TABLE V. HISTORY OF PRIOR ERYTHROBLASTOSIS OR TRANSFUSIONS

	WITH TREAT- MENT*	WITH PROPHYLACTIC TREATMENT	WITHOUT TREAT- MENT†
Total cases treated	24	79	128
Living	6	2 (transf.)	31
Died	3	0	14
Abortions	2	0	1
Total with positive history	11	2	46

\*Titer changes in treated cases: disappeared—2, none—4, increased 1 or 2 dilutions—4, increased 3 to 5 dilutions—6, decreased 1 to 2 dilutions—8.

†Out of 128 cases, untreated: decreased 1 dilution—6, decreased 2 dilutions—2, remainder increased or showed no change.

One patient in the prophylactic series had received 5 Rh-positive transfusions, 14 years previously. The patient stated she "nearly died from two reactions." She had no antibodies at 12 weeks and developed none while carrying her first pregnancy with delivery of a normal Rh-positive infant.

An autopsy on the one stillbirth showed no evidence of erythroblastosis grossly or microscopically, although no etiological factor was found.

### Conclusions

1. A series of 24 Rh-negative women with positive antibodies in albumin diluent were treated with anhydrohydroxy-progesterone and vitamin K.
2. One hundred twenty-eight untreated patients of similar nature are presented as controls.
3. There was no statistical improvement of the sensitized cases under therapy.
4. Seventy-nine women from Rh-incompatible matings were given progesterone and vitamin K prophylactically, with no case of sensitization.
5. Prior to current sensitization the use of anhydrohydroxy-progesterone and vitamin K appeared to have effect upon the prevention or control of erythroblastosis fetalis in this small series, and warrants study in a larger group for statistical verity.

### Addendum

Since the above report, 80 patients on prophylactic Pranone and Hykinone have been delivered of Rh-positive infants with no evidence of sensitization as evidenced by antibody titers. Four of these had had positive titers in preceding pregnancies.

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### Discussion

DR. HOMER L. PEARSON, Miami, Fla.—With regard to the effect of prenatal medications in the mother and their possible effect on Rh antibody reactions in the fetus, one must be extremely careful in drawing conclusions. The possibilities of protecting an infant from the action of a specific antibody must be directed toward (1) an effect on antibody-producing cells which will knock out their activity for the period of time during which the infant is carried in the uterus (while it is not known exactly which cells are responsible for the production of antibody, it is known that in order to reduce their antibody-producing proclivities one must rigorously treat the organism as a whole; the harmful effects on other cells of the body would almost certainly prevent the use of this type of approach in the pregnant

woman) or (2) the neutralization of antibody by substances which would specifically combine with Rh antibody and thus tie up the maternal antibody so it did not reach the infant in utero. It is well known that antigen-antibody reactions *in vivo* produce certain recognized signs such as various allergic manifestations including anaphylaxis, chills and fever, and other signs associated with the destruction of cells such as are noted in hemolytic transfusion reactions. In other words, the neutralization of antibody *in vivo* also carries with it some risk to the patient.

In recent years a number of different schemes have been proposed and tried out to carry out the condition mentioned in 1 above. For example, it was suggested that by giving large doses of some other antigen at the time the mother was developing Rh antibodies you would produce antibody for the antigen injected at the expense of producing Rh antibody. This was not found to be true and has been abandoned. The use of hormonal substances would most likely be considered to exert its effect on the antibody-producing cell. This certainly would be thought to be true by those who administer ACTH or cortisone to such women. While it is known that certain adrenal hormones seem to knock down the resistance and perhaps the antibody production in animal experiments, it must be realized that inordinately large doses of these substances are required to produce the antibody-lowering effect and it must be kept in mind that if you reduce the antibody-producing capacity of these cells in the pregnant woman you also reduce her ability to make antibodies for other antigens, including many bacteria, viruses, etc. The sum total effect over a long period would be to reduce the pregnant woman's entire immune mechanism. I believe it is possible that doses of these substances used clinically may effect a reduction in antibody titer for a short period of time but that it is likely this effect could not be prolonged for the period of gestation.

**DR. JOHN S. ZELENIK, Fort Benning, Ga.**—This paper by Glisson, Teate, and Smith is important and necessary since the work of Hoffman and Edwards had to be refuted or confirmed. After reviewing this paper one comes to the conclusion that the authors have apparently done both.

Since I do not feel that abortions are a complication of the Rh factor, and since in the series presented by these authors their incidence of abortions was less than would be expected in any group of normally pregnant women, I have taken the liberty of removing the abortions from their series. This gives us the following corrected figure in fetal wastage:

	TOTAL	FETAL LOSS	PER CENT FETAL LOSS
Treated	17	4	23.5
Untreated	120	24	20.0

These figures of fetal wastage agree fairly well with an over-all fetal wastage of 18.3 per cent reported by Bryce and associates, who recently reviewed 1,584 Rh-negative mothers, 71 of whom were sensitized. Statistically then, progesterone and vitamin K have not proved beneficial in the treatment of the Rh-negative mother with a positive antibody titer.

Holmstrom recently reported on 35 patients with antibody titers. He did not use vitamin K but progesterone in dosages of from 2 to 4 times the amounts used by Glisson Teate, and Smith. He concluded, "there is no evidence to indicate that the administration of Pranone will influence the outcome of a pregnancy complicated by Rh sensitization."

The 79 prophylactically treated patients are, however, of extreme interest. Statistically, one should expect slightly under 5 per cent of any group of Rh-negative mothers to have an infant with some degree of erythroblastosis. Our essayists report none. In these 79 prophylactically treated patients they have 30 primiparas. This leaves 49 multiparas who should conform to our statistical expectancy. Chance may have given them this result. Hoffman and Edwards, in their series of 50 patients, had only three patients with antibody titers, leaving 47 patients without titers. Of these 47 patients, 41 were multiparas. If we combine the figures of Hoffman and Edwards with those of Glisson, Teate, and Smith, we now have a series of 96 multiparas or a combined group of 126 patients in which no titer developed while under prophylactic treatment. This figure, it seems to me, is getting into the realm of the

significant, particularly since it comes from two different sources. Statistically five to six erythroblastotic babies should have been born in this group if up to 5 per cent of Rh negative mothers will have erythroblastotic infants. Both sets of authors state that no erythroblastotic infants were born.

We do not have in either of these studies some rather necessary information on the actual breakdown of the C, D, E blood groups in the fathers of these babies. It may be that chance has eliminated a sufficient number to give us the results obtained. A series of 1,000 would certainly be better than a series of 100; however, we cannot deny the evidence and must await additional reports.

Since the authors, in their prophylactic treatment, are treating a group of patients who have never been sensitized, I was a little curious to determine just how many patients could be expected to develop a titer during any period of observation. I investigated our records at the United States Army Hospital at Fort Benning, Ga. There were a total of 316 Rh-negative mothers. Of this number only 17 had titers, 14 had titers when they first came to us and 3 developed their titers under our observation. This gives us an incidence of approximately 5 per cent of patients with titers in our total Rh-negative group, but an incidence of only 1 per cent of patients who developed their titer while under our observation. This may mean that the expected number of erythroblastotic infants in the prophylactically treated group should be about 1 per cent instead of up to 5 per cent. This would tend to give the impression that a series of 126 infants is not a large enough series.

## LOWER NEPHRON NEPHROSIS IN PREGNANCY\*

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SINCE Lucké<sup>1</sup> reported his observations concerning acute renal insufficiency in war casualties during World War II many investigators have reviewed the etiology, pathology, clinical course, and occurrence of lower nephron nephrosis. The management of this condition is of particular interest because of its occurrence in obstetrical and gynecological patients.

It has been established that the pathological course of this condition is "self-limited"<sup>2</sup> to a certain extent and that conservative treatment during the acute phase is of ultimate importance for recovery of the patient.

Brief case histories of 5 cases that occurred on the obstetrical service of Roper Hospital in the past 2 years are presented. These cases illustrate the multiple etiological factors associated with this condition and include: (1) abortion, (2) incompatible whole blood, partial placenta previa, and postpartum hemorrhage, (3) premature separation of the placenta in a nonedematous patient, (4) septic abortion, and (5) premature separation of the placenta in a markedly edematous patient.

CASE 1.—D. P., a 24-year-old Negro woman, gravida vi, para v, abortion 0, was admitted to the obstetrical service of Roper Hospital on Jan. 6, 1951, because of vaginal bleeding. Her last normal menstrual period was in September, 1950; however, in October she spotted for 5 days. In December she had 2 episodes of vaginal spotting, each lasting 3 days. Three days prior to admission the patient stated that she had lost about 1 pint of blood and had had slight vaginal bleeding for the next 2 days. The day of admission the bleeding became more profuse and she was brought to the hospital.

Admission physical examination showed a well-developed, lethargic woman with a blood pressure of 104/62 and a pulse rate of 100 per minute. The mucous membranes were pale. The uterine contour was the size of a four months' pregnancy. There was a small amount of bright red vaginal bleeding.

Admission laboratory examination showed the hemoglobin concentration to be 6.0 Gm. per cent, erythrocyte count 2.3 million. The urinalysis showed a specific gravity of 1.022, 2 plus albumin and numerous white cells.

Immediately after admission the patient's blood was matched and cross-matched, and 1,000 c.c. of whole blood made available. A sterile vaginal examination was done. The cervical os admitted one finger, and was partially covered by placenta. The patient went into shock during the examination, but responded immediately to whole blood transfusions and continued to have uterine contractions with little vaginal bleeding. She received 1,000 c.c. of whole blood and after the blood pressure had been stabilized for several hours, with little vaginal bleeding and the cervix 3 to 4 cm. dilated and 50 per cent effaced, the fetus and placenta were delivered from below with ovum forceps. Approximately 400 c.c. of whole blood were lost while completing the abortion, but the patient received 500 c.c. of whole blood during the procedure.

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The urinary output the day of the abortion was 75 c.c., and the patient received 1,020 c.c. of fluid, plus 1,500 c.c. of whole blood. On the first postpartum day the urinary output was 100 c.c. and the intake was 3,380 c.c., plus 500 c.c. of whole blood. The second postpartum day the urinary output was 340 c.c. and the intake was limited to 1,100 c.c. At that time the blood urea nitrogen was 63 mg. per cent. The fluid intake was then limited to 1,000 c.c. plus the urinary output, and the urinary output gradually increased to 2,300 c.c. on the twelfth day. The blood urea nitrogen increased to 94 mg. per cent on the ninth day and gradually decreased to 18 mg. per cent on the twenty-sixth day.

The serum sodium, potassium, and chlorides showed no appreciable change during the patient's stay in the hospital.

*Comment.*—Case 1 is of interest because it represents the development of lower nephron nephrosis following an abortion, although the period of shock was only 3 to 4 minutes.

CASE 2.—E. J., a 27-year-old Negro woman, gravida vi, para v, abortion 0, was admitted to the obstetrical service of Roper Hospital on Jan. 23, 1950, because of toxemia of pregnancy and death of the fetus in utero. Her last normal menstrual period was May 2, 1949, and her estimated date of confinement was Feb. 8, 1950. The patient had felt no fetal movement for the past month and she had noticed that there had been no increase in the size of the uterus since movement stopped. She had received 6 million units of penicillin during her last pregnancy for the treatment of syphilis and was known to have sickleemia.

Admission physical examination showed a well-developed Negro woman in no distress. Her blood pressure was 140/90 and pulse rate 80 per minute. The fundus was 5 cm. above the umbilicus and no fetal heart tones could be heard.

Admission laboratory examinations showed the hemoglobin concentration to be 11 Gm. per cent and albuminuria 3 plus. An x-ray of the abdomen revealed considerable overlapping of the fetal cranial bones and marked flexion of the fetal spine.

Because of the presence of toxemia of pregnancy it was decided to evacuate the uterus and the membranes were ruptured at 4:00 P.M., Jan. 25, 1950, and approximately 50 c.c. of dark brown amniotic fluid obtained. At 3:00 A.M., Jan. 26, 1950, the patient experienced profuse vaginal bleeding, an estimated amount of 1,000 c.c., with an occasional uterine contraction. A sterile vaginal examination confirmed the suspicion of partial placenta previa. The periphery of the placenta was palpated partially covering the internal os which was 4 cm. dilated. A Voorhees bag was inserted and continuous traction applied to control the bleeding. After the bag was expelled a 3 pound, 7 ounce macerated fetus was delivered by breech extraction. One and one-half hours after delivery there was a severe postpartum hemorrhage and no blood pressure could be obtained for 20 minutes. At that time the uterus was packed. During the first 14 hours post partum the patient remained in and out of a shocklike state. She had received 2,500 c.c. of O Rh positive blood and shortly after receiving the fifth pint developed marked hemoglobinuria.

It is of interest to note that 4 years prior to this admission the patient had a similar blood transfusion reaction due to Rh positive blood and developed a marked hemoglobinuria and a blood urea nitrogen of 54 mg. per cent. At that time her Rh factor was typed positive and negative at different times, although the typing was done by the same person. This difficulty in Rh typing was also noted during this admission; however, only Rh positive blood was available for transfusion.

Fourteen hours post partum 250 c.c. of plasma were given and the patient responded, the blood pressure becoming stabilized at 120/85.

The first postpartum day the hemoglobin concentration was 9.5 Gm., and the volume of packed cells 17 mm. The third postpartum day the hemoglobin concentration was 5.5 Gm., and the volume of packed cells 14 mm. The urinary output was 40 c.c. the day of delivery and 220 c.c. the first postpartum day. The urinary output gradually increased to 1,190 c.c. on the sixth day and 3,870 c.c. on the ninth day. The blood urea nitrogen was 126 mg. per cent on the fifth day and 94 mg. per cent on the ninth day. The fluid intake was limited to 1,000 c.c. fluid plus the urinary output and the blood urea nitrogen gradually decreased to 17 mg. per cent on the thirty-third postpartum day.

*Comment.*—Case 2 represents the part that incompatible blood, particularly the Rh factor, plays in the production of the syndrome. Burt<sup>2</sup> reported 2 cases due to incompatible blood and in one case the reaction was caused by an Rh negative patient receiving Rh positive blood. Daniels<sup>3</sup> reported 13 cases of renal insufficiency following blood transfusion reactions in which 4 were fatal cases. The postpartum hemorrhage followed by the long period of shock played a great part in the production of acute renal insufficiency. Krakower<sup>4</sup> reported a case of lower nephron nephrosis following postpartum hemorrhage in which the patient experienced a transfusion reaction after receiving O Rh positive blood when the recipient's blood type was A Rh positive.

CASE 3. E. S., a 30-year-old Negro woman, gravida iv, para iii, abortions 0, was admitted to the obstetrical service of Roper Hospital on May 15, 1951, because of vaginal bleeding. Her last normal menstrual period was Aug. 16, 1950, and her estimated date of confinement was May 22, 1951. The patient had attended a County Clinic for prenatal care and stated that this pregnancy had been complicated by "high blood pressure." Labor began at 5:00 P.M., May 14, 1951, and a midwife was called at 7:00 P.M. Progress was slow and at 8:00 A.M., May 15, 1951, the patient began to have vaginal bleeding and was brought to Roper Hospital.

Admission physical examination showed a well-developed, Negro woman in moderate distress with a blood pressure of 170/100 and a pulse rate of 80 per minute. The mucous membranes were very pale. The uterus was the size of a full-term pregnancy, tense, and tender. No fetal heart tones could be heard. There was 1 plus, pitting ankle edema.

Admission laboratory examination showed the hemoglobin concentration to be 4.5 Gm. per cent and the red blood count 2.03 million. The urinalysis showed 4 plus albumin.

Immediately after admission the patient's blood was matched and cross-matched, and 1,000 c.c. of whole blood made available. After the blood transfusion had begun a sterile vaginal examination was done and the cervix was 4 cm. dilated, moderately thick, the head was presenting, and the membranes intact. The membranes were ruptured with a Wilson trocar at 12:30 P.M., May 15, 1951, to reduce the bleeding and to shorten the course of labor. At 2:27 P.M., May 15, 1951, the patient spontaneously delivered one stillborn infant weighing 7 pounds, 1½ ounces. An estimated 1,800 c.c. retroplacental blood clot was expelled at the time of delivery, and examination of the placenta revealed evidence of premature separation. There was no drop in blood pressure and very little bleeding post partum.

The patient excreted no urine on the first or second postpartum day. Eighty cubic centimeters were excreted on the third day and the urinary output gradually increased to 2,750 c.c. on the eighth day. The urea nitrogen was 40 mg. per cent on the first day and gradually increased to 94 mg. per cent on the thirteenth day. The urea nitrogen then gradually decreased and was 54 mg. per cent on the twenty-fifth postpartum day.

The patient signed out of the hospital against the advice of the physician at that time.

*Comment.*—Case 3 is an excellent example of acute renal insufficiency following premature separation of the placenta. It is interesting to note the absence of shock or any shocklike state in this case. Young<sup>5</sup> believes that there are two conditions in obstetrics, premature separation of the placenta and extensive trauma of labor, in which massive damage affecting the placenta, uterine muscles, or other pelvic tissues may be followed by renal insufficiency or azotemia. These two clinical states resemble the so-called "crush syndrome." These facts are in agreement with the theories of Paxson,<sup>6</sup> that there are two factors one must consider in the etiology of renal failure in such a case, the liberation of blood pigment into the general circulation which is excreted by the kidneys, and tubular damage.

CASE 4.—E. D., a 32-year-old Negro woman, gravida vi, para ii, abortions iii, was admitted to the gynecological service of Roper Hospital on July 21, 1951, at 3:45 A.M. because of vaginal bleeding with severe bilateral lower quadrant pain and dyspnea. The patient stated that her last menstrual period was June 27, 1951.

Admission physical examination revealed a middle-aged Negro woman in acute distress with an icteric tint to the sclera and a blood pressure of 138/95. The temperature was 101.2° F. and the pulse rate 94 per minute. Examination of the abdomen revealed only

bilateral lower quadrant tenderness, no rigidity, and normal peristalsis. Pelvic examination showed the cervix to be patulous with placental tissue (proved histologically) in the external os. Exquisite tenderness was present on manipulation of the cervix and the adnexal regions were negative.

Admission laboratory examination showed a hemoglobin concentration of 8.5 Gm., and a leukocyte count of 5,900. The blood appeared hemolyzed. Catheterization on admission was done and 20 c.c. of dark reddish brown urine obtained. This urine had an acid reaction,

Fig. 1.

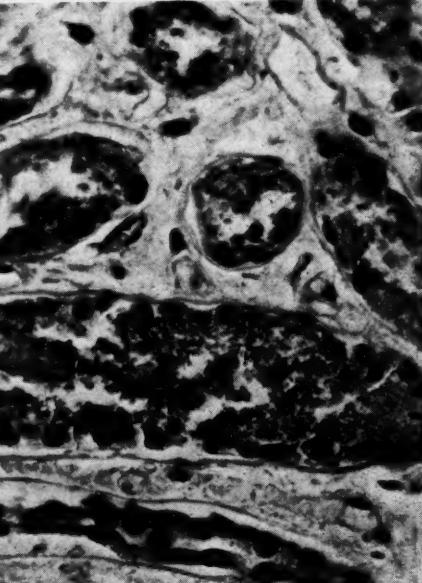
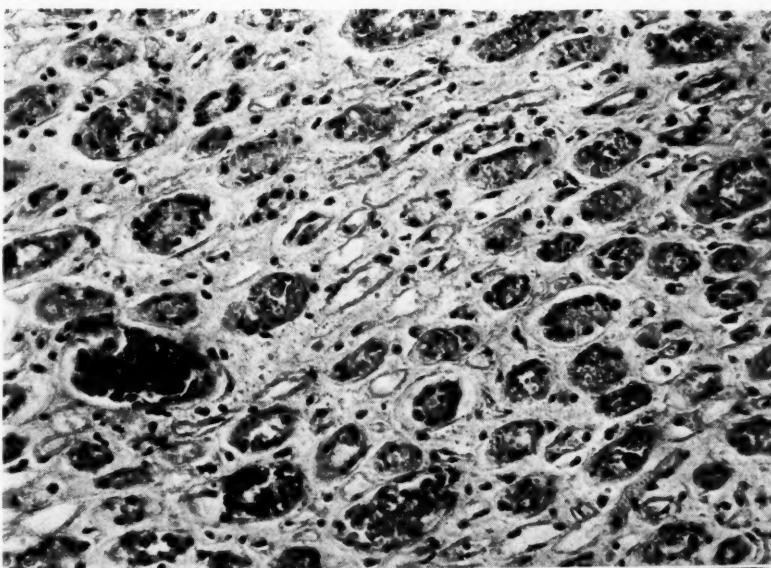


Fig. 2.

Fig. 1 (Case 4).—Section of the kidney to show the diffuse nature of the tubular plugging by heme casts ( $\times 200$ ).

Fig. 2 (Case 4).—Section of the kidney to show tubular degeneration associated with deposits of heme pigment ( $\times 400$ ).

an occasional red blood cell, no casts, and a positive benzidine test. The blood urea nitrogen was 22 mg. per cent. The icterus index and quantitative bilirubin could not be done because of the extreme degree of hemolysis. The blood culture and Coombs' test were negative.

Twelve hours after admission, despite whole blood transfusions, the hemoglobin fell to 6.0 Gm., the erythrocyte count was 1.44 million and the volume of packed cells was 15 mm. Matching and cross-matching were difficult due to extensive hemolysis in the blood sample. The blood urea nitrogen gradually rose to 94 mg. per cent prior to death. An indwelling catheter had been placed in the bladder and the urinary output was only 20 c.c. of dark brown urine after the initial catheterization. The temperature gradually rose to 106° F. just prior to death. The patient had a steady downhill course, expiring 77 hours after admission, despite whole blood transfusions (2,000 c.c.), antibiotics (penicillin, dihydrostreptomycin and Aureomycin), continuous oxygen and fluids. Diagnosis at necropsy was: uterus, post partum; icterus, generalized; hemoglobinuric nephrosis (lower nephron nephrosis). Gross diagnosis was: Enlarged kidneys (the right kidney weighed 320 Gm., the left, 290 Gm.) very dark (black-red) in color. On sectioning, the parenchyma showed a marked hemorrhagic discoloration and edematous appearance. Histological examination of the kidneys revealed marked degeneration of the epithelial cells lining the tubules and the lumen of nearly all the tubules were filled and packed with heme contents (Figs. 1 and 2). Cultures obtained at autopsy from the uterus were positive for beta hemolytic streptococcus, Lancefield Group A; and negative for *Clostridium welchii*. The specimen of liver sent to the chemistry department was found to contain no quinine.

We are at a loss to explain the etiology of this patient's severe hemolytic reaction, which led to her oliguria and death. There are many interesting possibilities.

1. The possibility that she may have ingested some chemical such as quinine.
2. The possibility that the beta-hemolytic streptococcus could form toxins which caused the hemolysis without septicemia.

*Comment.*—Wyatt and Goldenberg<sup>7</sup> state that lower nephron nephrosis has been reported rarely in fatal cases of septic abortions, possibly being overlooked because of the other more obvious and dramatic changes in the pelvic organs. Symmetrical cortical necrosis of the kidney, a probably much rarer phenomenon, has been more frequently described, no doubt because of its striking morphological characteristics and puzzling pathogenesis. Most investigators believe that these two apparently diverse renal lesions may have a common pathogenesis based on the mechanism of renal cortical anoxia.<sup>8</sup> Cortical necrosis is the manifestation of a more severe degree of ischemia or, at least, of ischemia involving more extensive areas of the cortex. The answer to the problem of oliguria following abortions may be that there is an interplay between the two factors of anoxia and heme pigment precipitation. A hypothetic nephrotoxic substance has been incriminated in the "crush syndrome,"<sup>9</sup> but it is difficult to account for such selective action by a chemical imbalance. It is far more logical to consider that the chemical substance is a humoral vasoconstrictor and that its mode of action is renal ischemia. The pigment cast may be thought of as being produced secondary to the release of hemoglobin and by the breaking down of erythrocytes which pass through the altered glomerular lesions. The theoretical substance may have had its origin in the retained placental tissue.

**CASE 5.**—M. S., a 36-year-old Negro woman, gravida ix, para iii, abortions v, was admitted to the obstetrical service of Roper Hospital at 11:15 A.M., Sept. 29, 1951, because of vaginal bleeding. Her last normal menstrual period was March 15, 1951, and her expected date of confinement was Dec. 22, 1951. Her prenatal care consisted of several visits to a County Clinic, where she was told that she was "doing well." She had felt no fetal movement for the past 24 hours. Uterine contractions had begun at 8:00 A.M. the day of admission, accompanied by vaginal bleeding.

Admission physical examination showed a well-developed Negro woman in moderate distress with a blood pressure of 160/110, and a pulse rate of 100 per minute. The mucous membranes were pale. The abdominal wall showed 2 plus edema and the lower extremities 3 plus. The uterus was enlarged to approximately the size of an 8 months' gestation, was tense to palpation, and no fetal heart tones were present.

Admission laboratory examination showed the hemoglobin concentration to be 6.5 Gm. per cent; erythrocyte count 3.1 million; volume of packed cells 22 mm. The urinalysis showed a specific gravity of 1.020 and 4 plus albumin.

Immediately after admission the patient's blood was matched and cross-matched, and 1,000 c.c. of whole blood made available. After the blood transfusion had begun a sterile vaginal examination was done at 1:30 P.M. the day of admission, and revealed the cervix to be long and thick. The internal cervical os admitted only one finger and no placental tissue was felt. At this time there was moderate vaginal bleeding from the cervical os. The membranes were ruptured with a Wilson trocar and a moderate amount of amniotic fluid obtained. At 4:45 A.M., Sept. 30, 1951, the patient spontaneously delivered one macerated fetus weighing 2 pounds,  $7\frac{1}{4}$  ounces. One thousand cubic centimeters of blood clot were expelled at the time of delivery. During the entire time the patient was in labor and immediately after delivery the blood pressure remained between 160/100 and 190/120.

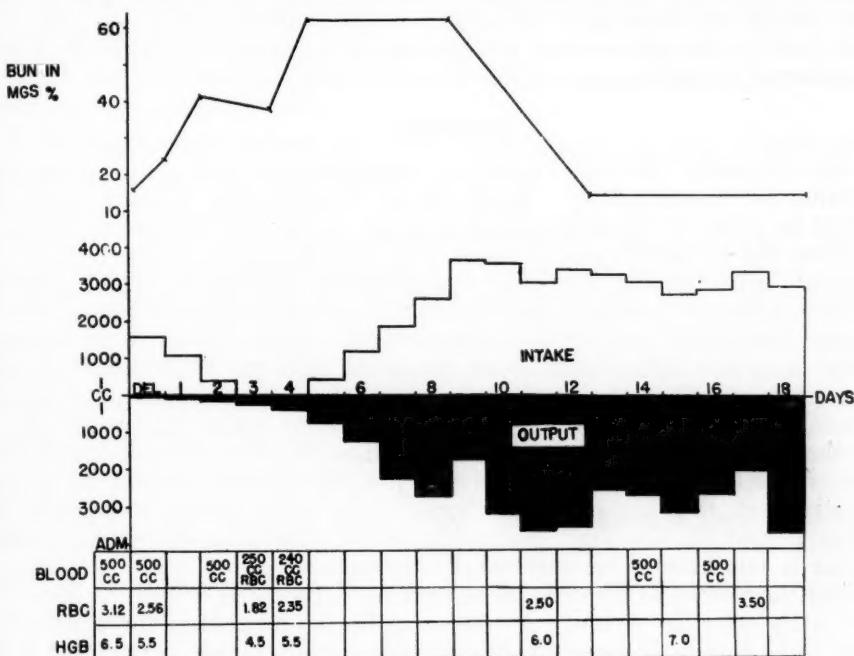


Fig. 3 (Case 5).—Relationship of the fluid intake, urinary output, and blood urea nitrogen.

Prior to delivery the patient had received 1,000 c.c. of whole blood and the day of delivery she received 1,520 c.c. of fluid by mouth and intravenously, but her urinary output was only 10 c.c.

The first day post partum she received 1,040 c.c. of fluid, 500 c.c. intravenously and 540 c.c. by mouth, and her urinary output was 20 c.c. The second day post partum she received 260 c.c. by mouth and 500 c.c. whole blood. At that time the patient's edema was becoming more marked and she developed fine râles throughout both lung fields. One thousand cubic centimeters of whole blood were withdrawn slowly to reduce the blood volume and 500 c.c. of whole blood with a known high hemoglobin content were given. The third day post partum she appeared to be improving with a urinary output of 155 c.c. She received no fluid, but did receive 250 c.c. of her own red cells that had been withdrawn the day before. The fourth day post partum her urinary output was 320 c.c. and she received no fluid except 240 c.c. of her own red cells. The patient's lungs were clear to auscultation on the fourth day post partum, and there was less facial edema. From this day on her condition gradually improved and by the tenth day her urinary output was 3,000 c.c. daily. Urinalysis showed only 2 plus albumin and 1 plus casts at that time. The urea nitrogen reached its peak of

63 mg. per cent on the fifth day and was 13 mg. per cent on the thirteenth day (Fig. 3). There was no marked change in her serum sodium, potassium, or chlorides during this period of diuresis.

**Comment.**—Case 5 represents many points that are of particular importance in the treatment of lower nephron nephrosis. In this case the patient did not receive excessive fluids, but still developed evidence of pulmonary edema. In the edematous patient, as represented by this case, pulmonary edema develops very rapidly and the restriction of fluid intake alone may not improve the edema. In such cases it may be necessary to do a phlebotomy to reduce the circulating blood volume. The hemoglobin concentration, in most cases, already is extremely low, but the red cells can be replaced immediately with a volume of whole blood with a known high hemoglobin concentration that is half of the volume withdrawn by phlebotomy. The blood withdrawn from the patient should be saved and the red cells used for transfusion later. This may be accomplished by allowing the red cells to settle while the bottle is turned upside down and then attaching a transfusion set to the bottle and allowing the concentrated red cells to be administered in the usual manner.

As in Case 3, this demonstrates the development of acute renal insufficiency in the absence of shock or a shocklike state.

### Comment

In the treatment of lower nephron nephrosis the precipitating factor or factors must be treated first. Whole blood transfusions, plasma, and other fluids must be given in the presence of oliguria or anuria to prevent immediate death. Once the patient is out of shock, the fluid intake is limited.

Gordon<sup>10</sup> reported one case and Fransworth<sup>11</sup> another in which the right kidneys were removed and necropsy disclosed the congenital absence of the left. These cases lived 27½, and 23 days, respectively, after the operations and the subsequent anuria. These and other reports<sup>12</sup> indicate that death in lower nephron nephrosis after the initial phase and before the state of diuresis is almost invariably the result of drowning the patient with excessive fluids. It appears that the caloric intake during the stage of oliguria and anuria is of secondary importance; however, wherever possible glucose should be given.

In retrospect, it is apparent that some of the cases received excessive fluid during the period of oliguria. Early diagnosis with immediate restriction of fluid intake is mandatory for successful treatment.

During the period of oliguria or anuria no definite rule, such as 500 c.c. or 1,000 c.c. daily plus the urinary output, can be set regarding the fluid intake. The daily fluid intake is governed by the amount of blood, plasma, and fluid given to combat the shock, the amount of edema present, and the urinary output. The edema present reduces the available storage space for excessive fluids and increases the possibility of the development of pulmonary edema and death. In the presence of marked edema it may be necessary to give no fluids by mouth or intravenously to prevent pulmonary edema. When the extracellular storage space and the vascular system are overloaded, phlebotomy may be a lifesaving measure. Following phlebotomy one-half the amount of blood removed is replaced in the form of whole blood that has a known high hemoglobin concentration or by transfusion with the patient's own red cells that have been withdrawn.

Diuresis usually begins between the second and twelfth days of oliguria, but spontaneous diuresis during the second and third weeks has been reported.<sup>12</sup> The phase of diuresis is marked by an electrolyte imbalance which is manifest by salt depletion. Sodium chloride must be given in sufficient quantity to replenish the losses. In addition, the moderate to severe anemia that is present must be treated by carefully matched blood transfusions.

In certain cases when there is a marked elevation of the urea nitrogen there is a corresponding elevation of the serum potassium resulting in potassium in-

toxication which will be fatal if not corrected. This can be detected early by the characteristic changes in the electrocardiogram. In such cases intestinal lavage<sup>13</sup> may be necessary to reduce the potassium level, and at the same time the urea nitrogen level will be reduced.

### Summary and Conclusions

1. Five cases of lower nephron nephrosis are presented which demonstrate the varied etiology of this condition in pregnancy.
2. Conservative replacement of the body fluids and maintenance of the electrolyte balance is mandatory during the phase of anuria and oliguria of this apparently reversible syndrome.
3. In the edematous patient it may be necessary to withhold all fluids for one or more days.
4. In the presence of pulmonary edema or impending pulmonary edema, phlebotomy is indicated.
5. Hypochloremia during the stage of diuresis is frequent and careful electrolyte balance must be maintained.

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### Discussion

DR. NORMAN THORNTON, Charlottesville, Va.—The authors have strikingly called our attention to the various and multiple factors which may be concerned in the production of anuria or oliguria as a result of renal tubular damage, commonly known as lower nephron nephrosis. The individual or combined factors of anemia, trauma of labor, shock, blood transfusion incompatibility, toxemia of pregnancy, and premature separation of the placenta which may produce this type of renal damage have been pointed out by illustrative case histories.

The authors have stressed that, in general, the renal damage is reversible and that the survival of a particular patient depends principally upon proper management. The proper maintenance of fluid and electrolyte balance during the phase of anuria or oliguria offers the only hope of survival in these patients, as emphasized by the authors. To disregard these fundamental principles of management invites disaster and risks death from pulmonary edema. The fact that 4 of the 5 patients survived this grave renal complication attests the authors' awareness of the proper management of this complication of pregnancy.

Recently Kelley and Vest of the Department of Urology of the University of Virginia Medical School were able to keep a patient in complete anuria from blood transfusion incompatibility, alive and in fluid and electrolyte balance for 23 days by peritoneal lavage. The procedure was discontinued on the twenty-third anuria day as kidney biopsy showed complete

cortical necrosis. The patient died 2 days later. It would seem that peritoneal lavage may permit additional time for tubular regeneration in those patients anuric for periods longer than 7 to 10 days.

DR. HENRY F. FULLER, Kinston, N. C.—Of the 5 obstetrical patients reported all, with possibly the exception of patient 4, presented at one time or another the picture of acute blood loss. This was evidenced by the elevated pulse rate even in the presence of compensated blood pressure in some instances and consistently and markedly reduced admission hemoglobin levels varying from 4.5 Gm. to 6.5 Gm. Regardless of the postulated theories on conditions leading to acute renal insufficiency, the obvious acute blood loss syndrome is paramount in the patients presented. In many such patients the damage may be done prior to their admission to the hospital. The extent of renal damage secondary to acute blood loss and trauma is always a variable factor. The renal ischemia responsible for the damage exhibited is unpredictable and may be related to pre-existing kidney disease.

The necessity of immediate and adequate whole blood replacement in all such shock cases cannot be overemphasized. Too little and too late is frequently the course of events.

The necessary immediate use of whole blood in large quantities is always fraught with its accompanying danger. The large majority of major incompatibilities encountered in whole blood administration are still due to the inevitable human error. It would seem worth while at this point to mention a satisfactory method, in the light of our present knowledge, of immediate treatment of hemolytic transfusion reactions. The patient exhibiting excruciating muscle cramps, chills, gross hemoglobinuria and hemolysis of serum is well known. The administration of whole blood prior to or after deep anesthesia, when feasible, will permit us to better observe these symptoms before prolonged infusion of incompatible blood. Once recognized the acuteness of this emergency has few equals:

The following measures are indicated in these cases:

1. Stop blood infusion immediately, when in doubt.
2. Check the serum for hemolysis and urine for hemoglobinuria as they will appear almost instantaneously.
3. Administer 50 c.c. of sodium bicarbonate 7 per cent solution intravenously, usually over a period of 5 minutes. Slow down if tetanic twitching or circumoral pallor is noted.
4. Administer 10 per cent dextrose in water solution intravenously as rapidly as possible, frequently as much as 2,000 c.c. in 1½ hours.
5. Combat shock by giving more whole blood if reason for incompatibility is obvious. If not, then administer plasma, polyvinylpyrrolidone, Dextran, gelatin or other blood substitutes.
6. Once diuresis starts continue intravenous administration of large quantities of dextrose in water over a period of 8 to 12 hours. If diuresis does not take place after 2,000 to 3,000 c.c. have been given, stop all intravenous infusion and resort to the conservative, restricted fluid regime so adequately stressed by the authors.

The importance of early diagnosis of acute renal insufficiency and immediate treatment in cases other than those caused by incompatible blood infusion has been emphasized by the speakers. In the management of these patients such measures as renal capsulotomy, splanchnic block, x-ray irradiation of the kidney, and spinal anesthesia have been almost entirely replaced by the conservative regime.

It is of interest that the patients presented did not show more marked evidence of electrolyte imbalance. The disturbance in potassium metabolism and resultant hypokalemia must be emphasized. The cardiac toxicity of the elevated potassium may produce fatality long before the complications of uremia are significant. The reported technique of Maluf would seem to be the most satisfactory method of combating this problem in the absence of an artificial kidney.

## THE INDUCTION OF PREMATURE LABOR BY MEANS OF PITOCIN IN PATIENTS WITH TOXEMIA OF PREGNANCY\*

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ALL obstetricians are faced at some time with the necessity for interrupting a pregnancy complicated by toxemia between the twenty-eighth and the thirty-fourth week. When the toxemia fails to respond to treatment, termination of the pregnancy is advisable for the sake of both mother and child. Once the decision has been made, with full knowledge that prematurity is a factor to be considered, the next question is what method to use. The majority of these mothers show no sign of impending labor such as engagement of the head or effacement and dilatation of the cervix. They have what is described so often in the literature as the "long, closed cervix." It is this type of patient, primigravida or multigravida, who is usually subjected to cesarean section.

The purpose of this paper is to describe a method of induction which permits vaginal delivery in such cases. We believe that the technique, because it achieves a normal birth, is preferable to the surgical approach, as it not only increases the infant's chances for survival, but also improves the outlook for future child-bearing on the part of the mother.

### Selection of Patients

In our cases the method has been used only when it has become apparent that persistence of the toxemia is hazardous to both mother and child. Many authorities, including Cosgrove,<sup>1</sup> Irving,<sup>2</sup> and Eastman,<sup>3</sup> have repeatedly stated that prolongation of intrauterine life in toxemia does not always bring the infant to term, as it may die, apparently, from the same disease suffered by the mother. The risk of prematurity is preferable to the chance of intrauterine death. These same authors have pointed out the hazards faced by the mother with toxemia: premature separation of the placenta, eclampsia, and residual hypertension when the toxemia is of long duration.

By and large, our selection of patients for interruption has been based on the criteria usually accepted which have been tabulated by Dieckmann.<sup>4</sup> Since our procedure requires several days, however, it is not used in patients showing evidence of a rapid progression of the disease, such as oliguria or uncontrolled eclampsia. In these cases, immediate interruption is imperative.

All patients with toxemia on admission to the North Carolina Baptist Hospital are placed on a standard regime of quiet, bed rest, sedation, and a high-protein, salt-free diet. Other treatment is provided as indicated. Blood pressure, albuminuria, weight, and urinary output are carefully watched and tabulated.

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### Method

In 1948, one of us (J. F. D.)<sup>5</sup> reported on the use of Pitocin for the induction of labor. Initially, we used fractional intramuscular doses, beginning with  $\frac{1}{4}$  min. and increasing the amount slowly until contractions were produced. The dose producing this response was then repeated at intervals of approximately 30 minutes for a period of 4 to 6 hours. Sterile vaginal examinations were done before and after the procedure so that the condition of the cervix could be definitely evaluated. This procedure was repeated on successive days until the patient went into labor or the cervix became favorable for rupture of the membranes. We learned from these early cases that repeated stimulation converted a long, firm cervix into one showing effacement and partial dilatation.

It is important to stress that all patients, then and now, were under constant supervision. The treatment for toxemia was maintained throughout the period of induction. The blood pressure, pulse, and fetal heart rate were recorded every 10 to 15 minutes, and the frequency, duration, and intensity of the uterine contractions were noted as they occurred.

With the reports of Lund,<sup>6</sup> Hellman,<sup>7</sup> and others, on the intravenous use of Pitocin, we began using this route of administration exclusively. Five minimis of Pitocin are placed in 500 c.c. of a 5 per cent solution of glucose in water, and is given by intravenous drip. The rate of administration is 9 drops per minute initially, and is increased according to the response. The average dose is around 20 to 30 drops per minute, and seldom have we found it necessary to go above 60 drops per minute. The contractions of the uterus at the onset are not painful to the patient but they can easily be felt by the observer and the duration, frequency, and intensity recorded. It is important that the dosage be increased slowly until the contractions are coming at regular intervals and lasting at least 30 seconds.

We prefer to administer Pitocin in the daytime for a period of 6 to 8 hours. If labor fails to occur, the patient is returned to her room for a night's rest. The procedure is repeated on successive days, or every other day, until labor starts or the cervix becomes favorable for rupture of the membranes. Usually, the condition of the cervix can be ascertained well enough from a rectal examination.

### Material

Since all of our patients, at the onset of induction, were believed to be several weeks before term, the usual precautions for the management of a premature infant were carried out at the time of delivery. All deliveries were done under local or regional block anesthesia, and the infants were immediately placed in the premature nursery.

TABLE I

	PRIMIGRAVIDA	MULTIGRAVIDA	TOTAL
Induction successful	12	6	18
Induction failed	0	1	1

We have treated a total of 19 white patients with delivery of premature infants (infants weighing less than 2,500 Gm.) in 18 cases.

Our one failure occurred in a 40-year-old woman in her fourth pregnancy who had 3 living children. She had had eclampsia during her first pregnancy and toxemia with the other 2. She was seen by us for the first time during the twenty-eighth week of pregnancy with a blood pressure of 200/120, albuminuria (4 plus), and no edema. The cervix, 4 cm. in length, was closed and there was no engagement of the presenting part. The patient was treated conservatively and the blood pressure fell to 160/110. The albuminuria decreased to 3 plus.

On the fifth hospital day the membranes ruptured spontaneously. Intramuscular Pitocin was started the following day and was given for 4 successive days, with little change in the cervix and only fair contractions of the uterus. A cesarean hysterectomy was performed 5 days after the membranes had ruptured, and a dead infant weighing 660 Gm. was obtained. The patient's postoperative course was normal, and her blood pressure was 140/90 at the time of discharge.

Pathological examination of the gravid uterus showed numerous small, elevated, pedunculated fibroids in the subserous portion, measuring 1 to 4 cm. and elevated as much as 3 cm. above the surrounding surface. Many large intramural nodules were found on the cut surface of the uterus, one of which measured 4½ cm. in diameter.

In the remaining 18 cases, labor was successfully established. One patient was admitted with ruptured membranes. The membranes were artificially ruptured in 10 patients, and ruptured spontaneously in 7. Pitocin was administered intramuscularly in 11 cases and intravenously in 7. The number of days on which inductions were carried out was evenly divided between 2 and 5.

In all except 3 patients examination prior to the induction revealed the cervix to be undilated and unengaged, and the fetal head unengaged. One of these 3 showed engagement but no dilatation. In the second the cervix was dilated 1 to 3 cm. and the head was at a minus 1 station. The third patient had 3 cm. dilatation of the cervix, but attempts to rupture the membranes were unsuccessful.

The blood pressure was recorded at 15 minute intervals throughout the procedure. In no case were changes noted during the induction or when labor finally ensued. There were no maternal deaths. One patient had inert labor which lasted more than 24 hours, but in all the other cases labor was less than 10 hours in duration. There were 2 cases of maternal morbidity, both due to endometritis. Both of these patients were in the initial group and had had repeated vaginal examinations.

TABLE II. ANALYSIS OF CASES IN WHICH LABOR WAS SUCCESSFULLY INDUCED

CASE NO.	MOTHER				CLASSIFICATION OF TOXEMIA	INFANT	
	AGE	PARITY	WEEKS PREGNANT	WEIGHT (GM.)		CONDITION ON DISCHARGE	
1	16	0	32	1,362	Pre-eclampsia	Good	
2	25	0	39	2,157	Pre-eclampsia	Good	
3	29	3	34	2,485	Pre-eclampsia	Good	
4	15	0	31	1,674	Pre-eclampsia	Stillborn	
5	28	4	30	1,192	Chronic hypertensive vascular disease	Good	
6	27	5	28	965	Chronic hypertensive vascular disease	Stillborn	
7	29	2	33	1,135	Chronic hypertensive vascular disease	Good	
8	18	0	34	2,072	Pre-eclampsia	Good	
9	24	1	37	2,490	Chronic hypertensive vascular disease	Good	
10	21	0	41	1,816	Pre-eclampsia	Good	
11	21	0	34	1,447	Pre-eclampsia	Good	
12	22	0	39	2,242	Pre-eclampsia	Good	
13	31	1	36	1,987	Pre-eclampsia	Good	
14	17	0	37	1,130	Pre-eclampsia	Neonatal death	
15	36	0	37	2,440	Pre-eclampsia	Good	
16	36	0	40	2,442	Pre-eclampsia	Good	
17	37	0	34	1,135	Chronic hypertensive vascular disease	Good	
18	33	0	35	1,986	Chronic hypertensive vascular disease	Good	

Three of the patients have had subsequent term pregnancies. All 3 of these pregnancies were complicated by mild toxemia.

Table II gives an analysis of the 18 cases in which labor was successfully induced. The cases are listed in the order as they occurred. The last 7 cases received intravenous Pitocin. The weeks of pregnancy are figured from the last menstrual period as given by the patient. We have used the classification of toxemia found in the latest textbooks of Eastman<sup>3</sup> and Greenhill.<sup>8</sup> All infants whose condition on discharge is listed as "good" weighed over 5½ pounds when they left the hospital. We have had no complete follow-up reports on these infants.

### Fetal Deaths

There were 3 fetal deaths, 2 stillbirths and 1 neonatal death.

The mother (D. R., NCBH No. 76988) of the first stillborn infant was a 15-year-old primigravida who had had no prenatal care. The expected date of confinement was uncertain, but she was thought to be about 31 weeks pregnant. She was admitted with severe pre-eclampsia and was treated conservatively for 5 days, with no improvement. Pitocin was given for 3 successive days, and the membranes were then ruptured artificially. Twenty-eight hours after rupture of the membranes she was delivered of a stillborn infant weighing 1,675 Gm. (3 pounds, 11 ounces). The fetal heart sounds disappeared 30 minutes before delivery. The patient was febrile at the time of delivery and for the first 5 days post partum.

No autopsy was obtained, but we believe that this infant died as a result of intrapartum infection. This case was one of the earliest in our series, and numerous pelvic examinations were performed to determine the effect of Pitocin on the cervix.

The second stillborn child was that of a 27-year-old multigravida (A. M. L., NCBH No. 84576) who had had 4 living children and a set of stillborn twins. This patient was admitted in the twenty-seventh week of her pregnancy because of vaginal bleeding and toxemia. Sterile pelvic examination done at the time of admission revealed the cervix to be 3 cm. long, and closed. The vertex was at a minus 3 station. The patient weighed 300 pounds. She was treated conservatively and at no time did she have any significant bleeding. On the fourth day of conservative therapy her blood pressure rose to 180/120. Intramuscular Pitocin was given on the next 2 days, and the following day the cord prolapsed. Pitocin was repeated, and she was delivered of a stillborn infant weighing 965 Gm. (2 pounds, 2 ounces).

The use of Pitocin in this case can be justly criticized because of the patient's multiparity. Her marked obesity, however, and the fact that according to the history she was only 27 weeks pregnant, persuaded us to try Pitocin. As far as we could ascertain, the membranes were probably ruptured at the time of admission. Prolapse of the cord is always a potential threat when the head is unengaged, and perhaps we are fortunate in having it occur in only this one case.

The neonatal death occurred on the second day of life. The mother of this infant was a 17-year-old primigravida (B. F. H., NCBH No. 113204) who was admitted to the hospital in the thirty-fourth week of pregnancy with severe pre-eclampsia. She showed no improvement after one week of conservative treatment, and labor was successfully induced by the intravenous administration of Pitocin over a period of 5 days. The infant was in complete breech presentation, and weighed 1,130 Gm. (2 pounds, 11 ounces) on delivery. On the second neonatal day the child died of aspiration pneumonia. Autopsy revealed digestion of the tracheal mucosa and also of the alveolar cells of the lung.

There was one other breech delivery in this series.

### Case Reports

We would like to report in detail 2 cases which illustrate the gratifying results of this procedure in the young primigravida.

CASE 1.—This patient was a 16-year-old primigravida, 32 weeks pregnant, who was admitted on Dec. 5, 1947, with severe pre-eclampsia. Her blood pressure was 176/118. Albu-

minuria, 4 plus, and marked edema of the ankles and face were present. She had been hospitalized in a near-by town for the past week, receiving treatment for severe toxemia with little or no improvement. She was known to have had an elevation of blood pressure and albuminuria for 4 weeks prior to her admission to the North Carolina Baptist Hospital. An appendectomy had been performed when the patient was 6 weeks pregnant, at which time her blood pressure was normal.

When the patient was admitted, the fetus was estimated to weigh 1,200 Gm.; it was in the vertex position and the head was floating. Laboratory studies showed the hemoglobin to be 13 Gm., red cell count 4,250,000, and white cell count 9,100. The nonprotein nitrogen was 50 mg. per 100 c.c., uric acid 6.7 mg. per 100 c.c., serum proteins 5 Gm. with albumin-globulin ratio 3:2, and serum chlorides 610 mg. per 100 c.c.

The patient was treated conservatively and received fairly heavy sedation with barbiturates. There was no improvement. The blood pressure varied from 180 to 140 systolic and 120 to 90 diastolic. The urine continued to show a 4 plus reaction for albumin, and on the third hospital day her total 24-hour output of albumin was 14 Gm. Sterile pelvic examination on the third hospital day showed the cervix to be 2½ cm. long; the os was closed and there was a vertex presentation at station minus 4. It was the consensus of all members of our staff that pregnancy should be interrupted.

Intramuscular Pitocin was given on the fourth hospital day, beginning with  $\frac{1}{4}$  min. A total or  $5\frac{1}{4}$  min. were used over a period of  $3\frac{1}{2}$  hours. There was no elevation of blood pressure, the fetal heart tones remained good, and the uterine contractions were mild, occurring at intervals of 2 to 4 minutes and averaging about 30 seconds in duration. On the fifth day Pitocin was administered over a period of 6 hours, the total dosage being 11 min. The response was about the same as that on the previous day. Following the second administration of Pitocin rectal examination showed the vertex to be at a minus 3 station and the cervix still closed. On the sixth hospital day,  $10\frac{1}{2}$  min. of Pitocin were given over a period of 5 hours, with a much better response. The station of the presenting part was now at minus 2, and the cervix was soft and dilated 1 cm.

The following day a sterile vaginal examination showed the cervix to be 1½ cm. long, with a 1½ cm. dilatation, and the vertex to be at a minus 2 station. The membranes were artificially ruptured. Pitocin was resumed, and 8 hours later, under local anesthesia and with the aid of episiotomy, the patient gave birth spontaneously to a normal infant weighing 1,362 Gm. (3 pounds). The child did well and was discharged from the hospital in good condition. The patient was discharged on the seventh postpartum day with a blood pressure of 120/80 and a trace of albumin.

This patient became pregnant again seven months later. She was admitted to the hospital for evaluation on Nov. 24, 1948, in the twelfth week of her pregnancy. Her blood pressure, while in the hospital, varied between 135 and 145 systolic and between 80 and 90 diastolic. Her urine was negative. Laboratory studies, including kidney function tests, were within normal range. She was followed closely in our prenatal clinic, and the highest blood pressure recorded was 140/90. She had no albuminuria at any time. On May 18, 1949, she was admitted in labor at term with a blood pressure of 140/90. Her blood pressure rose to 150/110 during labor, but at no time did she have any albuminuria. She was delivered spontaneously of a normal male infant weighing 6 pounds, 14 ounces. When she was discharged on the sixth postpartum day her blood pressure was 115/64 and it has remained normal since that time.

CASE 2.—Mrs. S. J. M., NCBH No. 105624, a 21-year-old primigravida, the wife of a medical student, was admitted to the hospital on Feb. 3, 1950, in the thirty-third week of pregnancy. Her prenatal course had been entirely normal until she was seen in our office on the day of admission, at which time her blood pressure was 160/110. Her urine contained albumin (2 plus) and she had gained 7 pounds in weight in the past 3 weeks. There was marked edema of the legs and face.

Laboratory studies at the time of her admission showed nonprotein nitrogen 41 mg. per 100 c.c., uric acid 6.4 mg. per 100 c.c. and serum proteins 7.1 Gm. The patient was immediately placed on heavy sedation with phenobarbital, supplemented with Seconal, and

was given magnesium sulfate intramuscularly. She was fed a high-protein, salt-free diet, and also received ammonium chloride for the edema. After one week of therapy the blood pressure was still elevated, the diastolic pressure remaining constantly above 100. The patient had lost 21 pounds in weight. On the tenth hospital day the blood pressure rose to 150/120 and remained there for a period of 24 hours. The uric acid was 8.9 mg. per 100 c.c. The urine showed a 2 plus reaction for albumin.

With these findings, interruption of pregnancy was considered necessary, and on the eleventh hospital day she was given Pitocin intramuscularly, beginning with  $\frac{1}{4}$  minim. The cervix at this time was 3 cm. long, undilated, and the head was floating. She received a total of  $\frac{3}{4}$  min. of Pitocin over a 3-hour period, with good response. The following day, for the first time in this series, we began the intravenous use of Pitocin. After receiving a total of  $3\frac{1}{4}$  min. over a period of 5 hours, the patient went into labor spontaneously and was delivered under local anesthesia 12 hours after the intravenous Pitocin was discontinued. The birth was spontaneous, and the infant, weighing 1,447 Gm. (3 pounds, 3 ounces), did well. The patient was discharged on the thirteenth postpartum day with a blood pressure of 120/80. At the time of discharge the urinary findings were negative.

This patient became pregnant again 9 months after delivery. Her prenatal course was normal, and she was admitted to the hospital in labor, at term, on Aug. 23, 1951. Her blood pressure on admission was 128/90, and her urine was negative for albumin. During labor her blood pressure went to 150/92. She gave birth spontaneously to a normal female infant weighing 6 pounds, 6 ounces and was discharged on the seventh postpartum day with a blood pressure of 120/80. Her blood pressure has remained normal since delivery.

Both of these patients would have been subjected to cesarean section if Pitocin had not been used. They were delivered of normal premature infants, both of whom are alive and well today. Since that time each patient has had a full-term pregnancy, with only a mild toxemia occurring during labor.

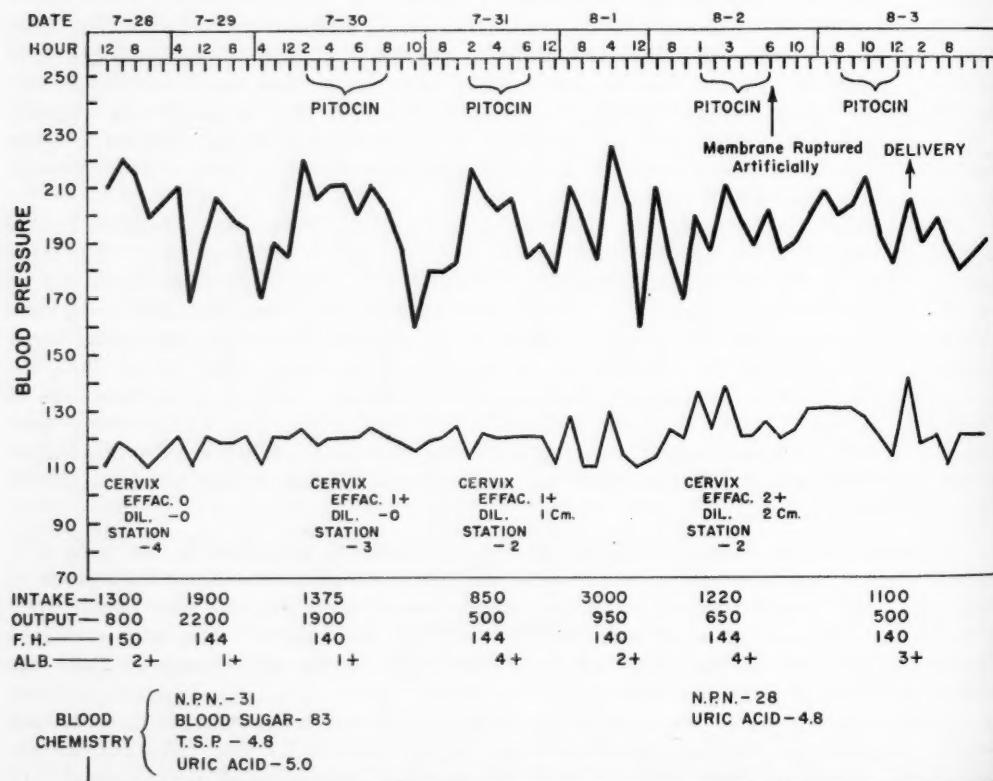


Fig. 1.

A case which we have classified as chronic hypertensive vascular disease with superimposed toxemia is presented to show the effect of Pitocin on the blood pressure and also the daily results of the induction (Fig. 1).

This patient was a 31-year-old white woman who had had one previous full-term pregnancy. She had been told that her blood pressure was normal at the onset of her present pregnancy and that it became elevated at the fifth month. She was first seen by us in the thirty-fourth week of pregnancy with a markedly elevated blood pressure and 2 plus albuminuria.

Intravenous Pitocin was started on the third hospital day. During the administration of Pitocin, recordings of the blood pressure, pulse, and fetal heart rate were made every 15 minutes but are shown only at hourly intervals on the graph. The initial elevation of blood pressure occurred before the Pitocin was started and is probably the result of the patient having been transported from her room to the labor room. As can be seen, Pitocin had no effect upon the blood pressure. The fetal heart rate remained around 140 throughout the procedure, and the patient's pulse rate varied between 72 and 80.

The patient was delivered of a normal male infant, weighing 1,987 Gm. (4 pounds, 6 ounces). Her blood pressure remained elevated post partum, and when she was seen 6 weeks after delivery, her systolic blood pressure was 186 and the diastolic varied between 140 and 110. In spite of numerous efforts, we have been unable to obtain any further information on this patient.

### Comment

Someone may question the use of the phrase, "induction of labor by means of Pitocin," in this paper since in a number of our cases rupture of the membranes was required to induce true labor. It is our opinion, however, that since the majority of these patients had long, closed cervixes with an unengaged head, and since this condition was changed by the Pitocin so that the membranes could be safely ruptured, the phrase "induction by Pitocin" is not inappropriate.

Eastman<sup>9</sup> has stated: ". . . in regard to the employment of intravenous Pitocin for induction of labor, our success has been almost nil in those cases in which we needed it, that is, in cases of preeclampsia with the cervix unfavorable for artificial rupture of the membranes." We have not found this to be the case in our experience, although we agree that failures are to be expected when Pitocin is given on only 1 day. Administration of the drug on successive days usually is required to change the long, closed cervix into one which is favorable for rupture of the membranes. We have proved to our own satisfaction that this method of inducing labor can safely be employed in toxemia of pregnancy, and we have used it successfully, not only for premature deliveries, but also in toxemic patients at or near term.

In this paper, however, we have presented only the cases in which labor was induced prematurely, in order to avoid the criticism that these patients would have gone into labor without the use of Pitocin. In view of the rectal and vaginal findings in this series of cases, we doubt seriously that any of the patients could have been delivered per vaginam in a reasonable length of time, if Pitocin had not been given. We do know that prior to our use of Pitocin for the induction of labor, these patients would have been seriously considered as candidates for cesarean section and a large majority of them would have been delivered in this manner. It is also true that some, in spite of the definite danger to the mother, might have been continued on conservative treatment in the forlorn hope of obtaining a live, full-term baby.

We have always felt that vaginal delivery is safer for a premature infant than cesarean section. The uncorrected fetal mortality in this series of cases is 16.7 per cent, which certainly compares favorably with any report of fetal mortality in infants weighing less than 2,500 Gm. Huber<sup>10</sup> has shown that premature infants delivered by cesarean section have less chance of surviving than those delivered by the vaginal route. The largest number of neonatal

deaths among premature infants in his series occurred in those born to mothers with toxemia. Johnson,<sup>11</sup> however, who seldom resorts to cesarean section in the management of severe pre-eclampsia and eclampsia at term, has stated that when toxemia before term necessitates the interruption of pregnancy, the safety of the premature infant is better served by cesarean section delivery. To this statement we cannot subscribe.

In our series the administration of Pitocin has caused no tetanic contractions of the uterus and no marked elevation of the blood pressure or pulse, and the fetal heart sounds have remained good. It must be reiterated, however, that all of our patients have been under close and constant supervision. We have great respect for the powers of Pitocin and do not advocate its indiscriminate use. There may be some who feel that our procedure is more radical than a cesarean section. We do not think that our results will bear out this belief. Our purpose has been to approach the problem of pre-eclampsia by a more conservative method which will not limit the future childbearing function of the mother or sacrifice the infant.

### Summary and Conclusions

1. A method is described by which Pitocin has been used to induce labor prematurely in 19 patients with toxemia. There was one failure in this series of cases.

2. The fetal salvage rate has been good (83.3 per cent), but in such a small series is of no statistical value.

3. Pitocin did not cause any marked elevation of the blood pressure or pulse rate in our patients. The fetal heart sounds remained good, and there were no tetanic contractions of the uterus.

4. Pitocin, given on successive days, can transform an "unfavorable" cervix in a toxemic patient to one with effacement and dilatation. If labor does not begin spontaneously, it is easily induced by artificial rupture of the membranes.

5. We advocate the use of Pitocin by this method only when the patient can be kept under constant supervision and observation.

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### Discussion

DR. R. GORDON DOUGLAS, New York, N. Y.—The authors have clearly presented a means of terminating pregnancy when indicated because of pre-eclampsia. This method has been referred to by others but here we have been acquainted with the details of management of 19 patients, all of whom subsequently delivered premature infants. Only one failure in such a group is an excellent record and the infant concerned weighed only 660 grams.

During the two years following July, 1948, at the New York Lying-In Hospital we induced labor in 44 patients by means of intravenous Pitocin for toxemia or hypertensive disease. While 32 of these women had infants that weighed over 2,500 grams they all had cervices that were considered relatively unfavorable for induction and we purposely avoided artificial rupture of the membranes or other aids in order to test the method under consideration. There were two failures and the first of these patients would undoubtedly have delivered if the method had been pursued further. Because of the unfavorable course of the toxemia, however, they were both delivered by cesarean section. I am firmly convinced that this procedure under such circumstances becomes the method of choice rather than persisting with the Pitocin induction. The number of courses of Pitocin employed was variable but in general more courses were required in those patients where the cervix was long and closed and the presenting part was high. There was no fetal mortality in this group of cases that could in any way be ascribed to the method of induction. I believe that it is well within the realm of possibilities that the deaths of the three infants reported by Dr. Mauzy and Dr. Donnelly were not caused by the method of induction employed.

We insist that the patient be under constant supervision as do the authors. We prefer that the procedure be preceded by a good night's sleep with sedation if necessary. A vaginal examination is always done prior to induction to determine accurately the condition of the cervix and the station of the head, etc. The induction is carried out on the labor floor and if unsuccessful after 6 to 8 hours the patient is returned to her room. We have used intravenous Pitocin in approximately 1,000 patients for varying purposes during the past 4 years but we still have great respect for the pharmacological action of the drug. Failure to follow the rules rigidly resulted in shock in a private patient when approximately 1/17 min. was administered over a period of 2 minutes. For the above reasons we are using the 2 bottle method of administration which consists of setting up 1 bottle containing Pitocin (Pitocin can be given in any strength of glucose, saline, molar lactate, distilled water, or blood, and will even mix with sodium sulfadiazine) and the other bottle free of the drug. They are connected to the needle by means of a Y attachment. By this method the infusion is begun with a solution free of Pitocin and a very gradual change can be made to the solution containing the drug.

The strength of the solution in our inductions is 6 min. per 500 c.c., while in the stimulation of desultory labor only 3 min. per 500 c.c. are employed. The strongest solution we have used thus far has been 120 min. per 500 c.c.; the largest amount given to any one patient was 350 min. (this was given under most unusual circumstances). The amount necessary to accomplish an induction or stimulation varies from 2 to 150 min. depending on the patient. The infusion is started using the Pitocin-free solution; several drops of Pitocin are added and then any untoward reactions are looked for. The Pitocin is very gradually increased until about 30 minutes later the solutions have been changed so that only the dilute Pitocin is running. The rate is adjusted to the response of the patient. If the patient's response is such that the infusion of Pitocin has to be run in at a greater rate than 40 drops per minute an additional amount of Pitocin is injected into the solution in order that the patient does not receive an excess amount of water. In this manner we have used a solution, on rare occasions, as concentrated as 120 min. per 500 c.c. (this is not recommended). The condition of the cervix and the station of the head are of little importance in an induction as long as no disproportion exists. We have given intravenous Pitocin inductions in patients where the cervix was completely uneffaced, 3 cm. long, with the cervix at the brim, and accomplished the induction successfully. However, a 3 stage induction was found to be necessary, consisting of 3 periods of 6 to 8 hours on successive days.

DuVigneaud, working in our hospital, has recently prepared a high potency preparation of the oxytocic principle of the posterior lobe of the pituitary gland in a highly purified form (700 to 800 units per milligram), by the technique of counter-current distribution. An analysis of this material for amino acids has shown the presence of leucine, isoleucine, tyrosine, proline, aspartic acid, glutamic acid, glycine, and cystine in equimolar ratios with about 3 moles of ammonia for each mole of any amino acid. This highly potent oxytocic prepara-

tion was found to be practically devoid of any pressor or antidiuretic activity. I have also prepared highly purified, high-potency preparations of vasopressin and found it to contain phenylalanine, tyrosine, proline, glutamic acid, aspartic acid, glycine, ammonia, arginine, and cystine with amino acids in approximately equimolar ratios to each other, again with 3 moles of ammonia for each mole of amino acid.

I consider it important to realize at this time that, to the best of my knowledge, no one has ever injected into a woman, via any route, absolutely pure oxytocic or pressor substances. Accordingly, it is impossible to be certain that our knowledge of the pharmacology of these principles is complete. It is well recognized that Pitocin, for example, contains varying amounts of pressor substance usually found to be from 5 to 10 per cent. In this connection it is significant to record that C. Scott Russell, working in the Nuffield Institute of Oxford University, found that commercially available Pitressin was 25 times more potent from an oxytocic point of view than Pitocin as determined by strips of human uterus muscle. Such data might indicate that the Pitressin in the Pitocin solution actually contains the oxytocic factor. Furthermore, the known differences in the pharmacologic action of these substances in the fowl, animal, and human being add further complexity to the problem. Before the final answer is available it will be essential to have these substances in chemically pure form for experimental studies. As soon as certain technical problems are solved we hope that it will be our privilege to employ the highly purified product for clinical trial.

From the point of view of present-day clinical use of Pitocin in obstetrics we must realize that we are dealing with one of the most potent biologicals available. Moreover, during labor an infinitesimal dose may have a profound pharmacologic action while prior to the onset of labor many times this dose would have no significant, observable effect on the uterus.

DR. JOHN D. MILTON, Miami, Fla.—At Jackson Memorial Hospital, in a 2 year period from March, 1949, to March, 1951, we had 47 cases of toxemia, 35 of pre-eclampsia and 12 of eclampsia. Seven patients had cesarean sections, for which we are not particularly proud; however, we felt that it was necessary in an effort to save the mother's life. There were a total of four inductions with intravenous Pitocin, when the cervix was dilated 4 to 5 cm. and the membrane was ruptured. All inductions were successful. We used only intravenous Pitocin. To me the interesting and intriguing part of Dr. Mauzy's inductions was the trial of Pitocin on several consecutive days. Therefore, since hearing this paper our department will endeavor to induce labor in toxic women that have improved to a certain point but will not improve further, to see if we cannot convert the long, firm, undilated, and uneffaced cervix to one that is more favorable for labor.

I would like to drop a word of caution. We recently had one reaction to Pitocin. This patient was a 39-year-old primigravida with cardiohypertensive vascular disease. During the entire prenatal period the blood pressure ranged from 140 to 150 systolic and 80 to 100 diastolic, but when she was admitted to the hospital the blood pressure was 190/120. Conservative treatment brought the blood pressure down to 150/100. It was felt that induction should be attempted because of an unusually large baby and a borderline pelvis. Therefore, at 36 weeks an induction was started using 1 min. Pitocin per 100 c.c. glucose solution in distilled water. The solution was started at 12 drops per minute. Approximately 4 minutes after the intravenous Pitocin was started, the blood pressure jumped to 200/120 and remained there continuously; therefore, it was felt advisable to discontinue induction. Four days later a similar induction was attempted with  $\frac{1}{2}$  min. Pitocin per 100 c.c. of solution. Blood pressure, which in the meantime had returned to the previous level, rose to 200/150 and remained there over a period of 2 hours; therefore Pitocin was discontinued. No further attempt with Pitocin was made. The patient was delivered with midforceps two weeks later without mishap, the blood pressure remaining at a level of 140/80.

## OCCULT RUPTURE OF THE UTERUS\*

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**R**UPTURE of the uterus is one of the most serious obstetric complications. It is the cause of 5 per cent of all maternal deaths.<sup>1</sup> It is almost universally fatal to the infant and frequently causes death of the mother. Over 700 papers have been written on rupture of the uterus since it was first described in 1875 by Bandl.<sup>2</sup> Its etiology, pathology, symptoms, and treatment have been repeatedly discussed. The classical picture of rupture with fetal death and maternal shock, the increased incidence of rupture in postoperative uteri and the necessity for early and vigorous treatment have been recently summarized in excellent discussions by Morrison,<sup>3</sup> Brierton,<sup>4</sup> Eastman,<sup>5</sup> and Beacham.<sup>6</sup>

The addition of this relatively modest series of patients to the already enormous body of literature on the subject would scarcely be justified were it not for the following objectives: (1) to examine the incidence of rupture of the uterus in a clinic in which the cesarean section rate is very low, and in which the dictum of "once a cesarean, always a cesarean" is often not employed, (2) to emphasize (a) that the diagnosis of rupture of the uterus is quite often obscure and difficult to make (in this series, the diagnosis of rupture of the uterus was missed, at the time of rupture, almost as often as it was made) and (b) that to make the diagnosis of occult rupture of the uterus early, the condition must be suspected frequently.

The term occult rupture of the uterus is applied here to those ruptures which do not exhibit the classical symptoms of sudden pain, cessation of labor, fetal death, and maternal shock. This discussion will concern primarily the signs, symptoms, and early diagnosis of occult rupture.

### Method of Study

The 16,654 consecutive deliveries done in Duke Hospital in the period ending in November, 1950, were reviewed. The records of all patients undergoing cesarean section were examined. All records diagnosed as having rupture of the uterus, including those of patients dying in the emergency room or admitted to the wards in irreversible shock, were reviewed.

### Results

The survey made of the cesarean sections performed by both the visiting staff and house staff during this period showed the results given in Table I.

The incidence of cesarean section on this service is obviously low. This is accounted for by a very conservative attitude on primary cesarean section

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and by the fact that 33 per cent of our patients with postcesarean uteri were allowed to deliver vaginally. The relatively large number of patients thus delivered without a single rupture of the uterus indicates that such conservatism is tenable as far as rupture of the uterus is concerned. However, it is of prime importance that labor in patients with postcesarean uteri be conducted with the utmost respect. While such patients are frequently delivered through the pelvis in this clinic, pelvic delivery is attempted only under rigidly controlled conditions. It has been our policy not to attempt vaginal delivery following cesarean section unless each of the following conditions is satisfied:

1. The patient is not opposed to an attempt at pelvic delivery.
2. Adequate pelvic measurements and architecture are demonstrated by x-ray pelvimetry.
3. The previous operator possessed adequate skill.
4. The postoperative course following the previous cesarean section was essentially afebrile.
5. A member of the staff must be in constant attendance at the bedside during labor.
6. Cross-matched whole blood must be available throughout labor.
7. An operating room must be available through labor.

TABLE I. CESAREAN SECTION

	NUMBER	PER CENT
Total deliveries	16,654	
Incidence of cesarean section	217	1.30
Primary cesarean section	144	0.86
Patients with previous cesarean section	108	
Repeat cesarean	73	0.44
Vaginal delivery of patients with previous cesarean section	35	33
Instance of rupture of the uterus in these 35 patients	0	

In a total of 16,654 deliveries, rupture of the uterus occurred 13 times, giving an incidence of 1 in 1,281 deliveries.

TABLE II. RUPTURE OF THE UTERUS

AUTHOR	INSTITUTION	TOTAL DELIVERIES	RUPTURE OF THE UTERUS	
			NUMBER	INCIDENCE
Ingram, Alter, and Carter	Duke Hospital	16,654	13	1:1,281
Lynch <sup>6</sup>	Tufts College Medical School	41,706		1:1,118
Morrison	University of Maryland	65,916		1:1,465
Eastman	Johns Hopkins Hospital	53,574		1:1,010
Brierton	Bellevue Hospital	111,753		1:1,961

The more interesting aspects of the thirteen ruptures of the uterus are demonstrated in Table III.

In most respects, these findings were in keeping with those reported by others. Multiparity was almost universal. The etiological factors were not unusual except for the relatively high proportion which followed injudicious use of oxytocics (Fig. 1). All four ruptures due to oxytocics took place outside the hospital. The incidence of rupture of the lower uterine segment under conditions of stress has been emphasized many times before. The mortality rate was comparable to most other reported results. There were

5 maternal deaths in this series. Three deaths followed rupture before admission to the hospital and 2 followed rupture after admission. In a majority of the reports reviewed by Eastman<sup>1</sup> the maternal mortality rate varied between 42 per cent and 53 per cent and the fetal mortality rate averaged 83 per cent.

TABLE III. CLINICAL FACTORS IN THIRTEEN PATIENTS WITH RUPTURE OF THE UTERUS

	CLINICAL FACTORS	NO. PATIENTS
Race		
	White	7
	Negro	6
Parity		
	Multipara	12
	Primipara	1
Etiology		
	Injudicious use of oxytocics	4
	Version and extraction	3
	Prolonged labor, inertia, pre-eclampsia	2
	Spontaneous	2
	Previous cesarean (low cervical)	1
	Cephalopelvic disproportion	1
Time of rupture		
	Before admission	5
	After admission	8
Site of rupture		
	Lower segment (trauma, scar, dystocia)	11
	Upper segment (spontaneous)	2
Delay in diagnosis		
	No delay (classical picture)	8
	Definite delay (diagnosis not obvious but could have and should have been made earlier)	5
Length of delay in diagnosis		
	4 hours	1
	11 hours	2
	16 hours	1
	11 days	1
Mortality		
	Maternal	5
	Fetal	13

There was a definite delay in diagnosis in 5 of the 13 patients. Because this discussion is primarily concerned with the delay in diagnosis, the following illustrative case summaries are presented.

**CASE 1.**—A 29-year-old Negro woman, para iii-i-i was admitted at the seventh month of pregnancy because of severe pre-eclampsia. The following day labor began spontaneously. The infant was small (2,100 grams) and in left occipitoanterior presentation. After 7 hours of labor the fetal heartbeat stopped abruptly and the patient complained of suprapubic pain. Four hours later a maternal tachycardia of 140 beats per minute was noted. This persisted for 7 hours until external hemorrhage of 3,000 c.c. of blood occurred. Profound shock appeared promptly. Abruptio placentae was suspected. A pelvic examination was done 11 hours after cessation of the fetal heartbeat and a rupture of the lower uterine segment was found. The infant was dead and partially delivered into the abdominal cavity. The patient was given 4,000 c.c. of whole blood and subtotal hysterectomy was performed. The patient died in shock 24 hours after operation.

**CASE 2.**—A 24-year-old Negro woman, para i-0-i with severe pre-eclampsia was admitted in labor at 8 months' gestation. After 10 hours of desultory labor, Thoms pelvimetry was done. The pelvis was adequate and the presentation right occipitoanterior. The cervix dilated fully with 12 hours of labor. After 2 hours of very poor second-stage labor, with the

head still 1 cm. above the spines, the fetal heartbeat ceased abruptly. The patient began to complain of bladder tenesmus. Her contractions became weak and ineffectual, but were still palpable every 4 to 7 minutes. She was purposely allowed 12 hours in the second stage, less than half of which was good labor, in an effort to avoid a high forceps, or cesarean on a dead baby. Four injections of Pitocin, 1 min. each, were given after 12 hours in the second stage without causing good labor or descent. Sterile pelvic examination was then done and the right shoulder was found to be overriding the symphysis. Rupture was suspected but could not be proved. Craniotomy and cleidotomy were done. After delivery a rupture of the anterior lower uterine segment was found. Total hysterectomy was performed and was followed by an uneventful convalescence.



Fig. 1.—This 32-year-old Negro multipara, para iii-0-iii, began labor spontaneously at term with a breech presentation. After 9 hours of labor she was visited in the home by her physician, and the cervix was found to be 6 cm. dilated. Pituitrin, in unknown amounts, was given in 2 injections, 10 minutes apart. Classical rupture of the uterus occurred 5 minutes after the second injection. The patient was admitted to the emergency room *in extremis* and died before treatment could be initiated. At autopsy, a 15 cm. rupture was found in the left posterior portion of the lower uterine segment.

CASE 3.—A 24-year-old Negro woman had had a right salpingo-oophorectomy for ectopic pregnancy 2 years prior to this pregnancy. No incision had been made into the uterus. Her present pregnancy had progressed to term without difficulty. Nine days prior to admission she experienced a gradual onset of labor, had good contractions every 5 minutes for 16 hours without delivery, then noticed a gradual spacing out and disappearance of contractions. Fetal motion ceased and the patient felt a little weak. Nevertheless she performed her daily house and farm work and rode 8 miles daily to see her doctor for the next 6 days. For 4 days prior to admission she experienced progressive gaseous distention. On admission, 9 days after onset of labor, the pulse was 140 but the patient had no complaints other than distention. The uterus and fetus could not be palpated through the distended abdominal wall. The fetal heart beat was absent. A flat plate showed a term fetus, probably dead, lying with the long axis in an anteroposterior direction under the liver (Fig. 2). A tentative diagnosis of rupture of the uterus was made. Operation was deferred for 36 hours because

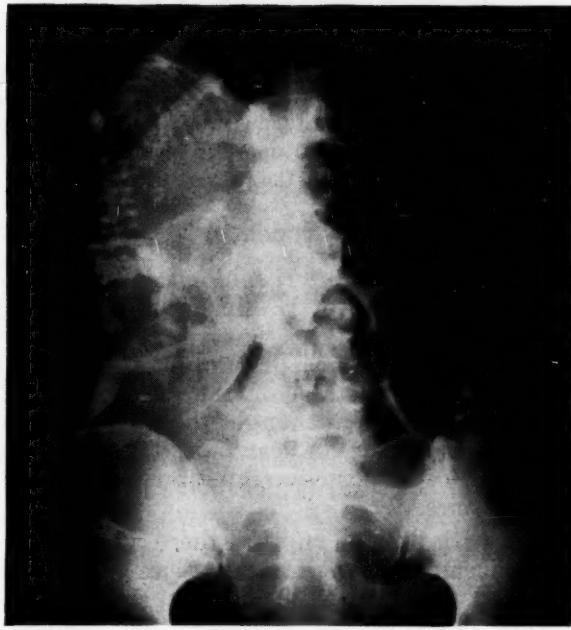


Fig. 2.—This flat plate of the abdomen, taken 9 days after rupture of the uterus, demonstrates a dead term fetus lying under the liver with the long axis in an anteroposterior direction. Note the soft tissue shadow of the uterus above the pelvic inlet and the dilated loops of bowel.



Fig. 3.—At laparotomy, 11 days after rupture, the fetus and placenta were found lying free in the abdominal cavity with the left foot presenting in the incision. The uterus is held in the tenaculum on the right.



Fig. 4.—Total hysterectomy was performed. A rupture 8 cm. in length was found in the right side of the fundus. The fetus and placenta showed no changes except maceration.

of marked anemia (hemoglobin 40 per cent), dehydration, and distention. Meanwhile, she was given 4,500 c.c. of whole blood. On pelvic examination the uterus was found to be empty. A rupture of the right side of the fundus was identified. At laparotomy the fetus and the placenta were found lying free in the upper right abdominal cavity (Fig. 3). Total hysterectomy was done (Fig. 4) 11 days after the rupture occurred. Recovery was uneventful.

### Comment

The concept that postcesarean uteri seldom rupture during labor is by no means new. However, this viewpoint is still not widely accepted. Irving,<sup>9</sup> at Boston Lying-in Hospital, and others have reported large series of postcesarean labors without one instance of rupture. It should be pointed out again<sup>6, 7</sup> that even though all details of the previous cesarean section are known to be favorable and even though the previous convalescence was smooth, the integrity of the cesarean scar is still not guaranteed. Similarly, one safe pelvic delivery of a postcesarean uterus does not guarantee subsequent safe pelvic deliveries.

In the 13 patients with uterine rupture there was only 1 patient in whom failure to employ cesarean section instead of an attempted pelvic delivery might possibly have led to rupture. This rupture occurred in the presence of a long inertia type of labor and borderline cephalopelvic disproportion. The conservative management of this patient may have been an error, but in employing the same conservative attitude in all patients we believe that many unnecessary cesarean sections have been avoided.

The concept that rupture of the uterus is frequently an obscure or occult phenomenon is not a new one. Titus,<sup>10</sup> Eastman,<sup>5</sup> Beacham,<sup>6</sup> Stander,<sup>11</sup> and others have mentioned occult rupture, but it is felt that specific emphasis has never been placed upon the subject. Classical rupture can be diagnosed by the patient or by her relatives. Occult rupture tests the diagnostic acumen of the physician. It is upon the symptoms of occult rupture that he should focus his attention. As in the diagnosis of ectopic pregnancy, one must think about the diagnosis of rupture of the uterus frequently in order to make the diagnosis occasionally. In any difficult labor, any one of the following signs should lead to a suspicion of occult rupture of the uterus:

1. When descent does not occur in the presence of good labor and favorable presentation.
2. When the patient complains of suprapubic pain and bladder tenesmus.
3. When unexplained maternal tachycardia occurs during labor.
4. When the fetal heartbeat ceases abruptly.
5. When unexplained intrapartum or postpartum hemorrhage occurs.
6. When the "intuition of the patient" suggests rupture (Cooke<sup>12</sup>).

The histories of Cases 1 and 2 demonstrate that, in retrospect, all the signs of rupture of the uterus were present. The rupture was not diagnosed because it was not suspected. Diagnosis was finally made 11 hours and 16 hours, respectively, after rupture.

Case 3 is interesting in that the uterus ruptured spontaneously during what appeared to be simple false labor. The gradual onset and gradual disappearance of contractions were probably accounted for by the slow delivery of the fetus and placenta through the fundal rupture. There was no pain and no shock. The patient resumed her household duties for the next 6 days. The radiologic studies demonstrated the typical x-ray findings of rupture of the uterus, i.e., a fetus showing the signs of fetal death and occupying the upper part of the abdomen, a soft tissue mass in the pelvis representing the uterus,

and gaseous distention of the intestine caused by hematoperitoneum. A similar case was reported 25 years ago by Williams<sup>13</sup> in which rupture of the uterus and intra-abdominal delivery occurred 14 days before operation.

### Conclusions

1. A low incidence of cesarean section in this clinic has not increased the incidence of rupture of the uterus over that reported elsewhere.
2. The frequent pelvic delivery of patients who have had previous cesarean section has not led to any instance of rupture of the uterus in this clinic.
3. The diagnosis of rupture of the uterus is often obscure, and early diagnosis is often difficult.
4. The maternal mortality rate of rupture of the uterus, now one of the highest encountered in any obstetrical complication, can be substantially reduced by earlier diagnosis of occult rupture.
5. The diagnosis of occult rupture of the uterus, to be made early, must be considered frequently.

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### Discussion

DR. H. M. ALLISON, Greenville, S. C.—I have had the misfortune of having a uterus rupture under my hand when labor seemed to be progressing normally and in this case the diagnosis was made at once. As Dr. Ingram has said, those uteri presenting a less dramatic rupture are often difficult to diagnose, and test the acumen of the attendant to the fullest. His final conclusion, that the diagnosis of occult rupture, to be made early, must be considered frequently, is certainly an admonition to be remembered. Had this been done, I am sure the two cases I shall cite would have been handled very differently and their courses would have been much less hazardous. In retrospect both these cases are easily diagnosed, but at the time occult rupture was not suspected by those having charge of the treatment, even though many of the criteria for diagnosis, as outlined, were present.

The first patient was a white multipara, age 36 years, para i, gravida iii. Her past history was not remarkable. She had had an appendectomy and, some years later, a right salpingo-oophorectomy. Her first pregnancy, in 1948, was uneventful and a 7 pound infant was delivered with low forceps after 13 hours' labor. Her postpartum course was normal. Her second pregnancy terminated in a spontaneous abortion at 2½ months, no curettage being necessary.

The third pregnancy was remarkable only because of the patient's long and bitter complaints about everything on every prenatal visit and her very definite refusal to follow any instructions as to an adequate diet, fluids, exercise, or anything else. She went into labor spontaneously at term, progressed more rapidly than expected, and cooperated

very nicely. After 6 hours, caput was visible and an outlet forceps delivery of a 6 pound, 3 ounce infant was carried out with difficulty. A first degree laceration was repaired and the third stage was normal. The blood loss did not exceed 250 c.c.

Three hours after delivery, the nurse recorded a pulse of 120 for one reading. The patient voided once after delivery but thereafter catheterization was necessary. The next morning, 10 hours after delivery, there was some abdominal distention but this was not a striking feature. When the patient resumed her long line of bitter complaints regarding her condition and that of women in general, it was felt that she had returned to her normal state. However, such was not the case. She did not improve and 30 hours post partum, a Miller-Abbott tube was used to relieve the increasing distention. At this time she localized her pain over the left lower quadrant, her temperature was 101° F. and pulse 100. Three days after delivery she was acutely ill and a diagnosis of intestinal obstruction was made. Laparotomy revealed a ruptured uterus, the rent being in the lower segment and extending out into the left broad ligament. A large hematoma and a moderate amount of free blood were present, in the left lower quadrant. A supravaginal hysterectomy was done and her postoperative course was not unduly stormy. Apparently the rupture occurred just at the end of labor.

The second patient was a young Negro woman of 21 years, para i, gravida ii. Her first baby was delivered by her private physician by a classical cesarean section for cephalopelvic disproportion, a year and a half before this pregnancy. She was again under the care of her own doctor and apparently had had a normal pregnancy until Jan. 21, 1951, when she was admitted to the hospital at 8 months' gestation and complaining of irregular lower abdominal cramps and slight vaginal bleeding. She was treated for threatened premature labor, but continued having the same complaints for 2 days. The pain ended at night with a severe knifelike pain that caused the patient to cry out. The next morning, she was discharged in good condition.

At her next office visit, her doctor believed he was dealing with an abdominal pregnancy since the baby was found lying in the upper abdomen. No fetal heartbeat or movements could be detected and she still had a fair amount of vaginal drainage. To prove this diagnosis uterosalpingography was done. Droplets of Lipiodal were seen in the pelvis, and the baby was visible lying in the upper abdomen.

Following this procedure, the patient developed severe abdominal pain, fever, nausea and an extremely foul mucopurulent vaginal discharge. She was admitted to the hospital on Feb. 16, 1951, as a service patient and was seen by me at that time. The patient was desperately ill, extremely anemic, and nothing could be outlined through her rigid abdomen.

The diagnosis at this time was clear and the patient was prepared for surgery. When the abdomen was opened conditions were found even worse than expected, with the baby, a macerated stillborn infant lying in the upper abdomen, along with the placenta. Adhesions, old blood, necrotic material, and an almost overpowering odor added to difficulty of treating this unfortunate and desperately ill woman. A supravaginal hysterectomy was done, and abdomen drained through the left side, the tube lying along the left broad ligament where the rupture apparently took place, and a cecostomy was done.

Her postoperative course was extremely stormy but with blood, fluids, intensive antibiotic therapy, she managed to survive and was discharged on the forty-seventh post-operative day.

## MANAGEMENT OF HEART DISEASE IN PREGNANCY\*

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PRIOR to July, 1947, all obstetrical patients suspected of having any cardiovascular abnormality were referred to the adult cardiac clinic. This necessitated a preliminary examination in the general medical outpatient department and often resulted in a delay of 3 to 6 weeks in obtaining an opinion as to the patient's cardiovascular status. In July, 1947, a cardiac consultation service was established in the Obstetrical Clinic to expedite the obtaining of a cardiac diagnosis and to coordinate the obstetrical and medical management of these patients. All patients suspected of any cardiovascular abnormality were referred for evaluation. The great majority were found to have only a functional systolic murmur associated with pregnancy. Those patients having organic heart disease were followed jointly through prenatal care, delivery, and follow-up examination.

### Material

Complete records were available for study on 37 pregnancies covering a period from July 1, 1947, to Oct. 1, 1951. During this time 10,038 patients were delivered on the ward service which represents an incidence of 0.34 per cent. This incidence of heart disease in pregnancy is lower than that in other series; the average is approximately 3 to 4 times as great as that reported in this group. Seven patients were not delivered in the hospital; of these, 2 transferred to another city and the remaining 5 were out-of-town patients and were delivered elsewhere.

Table I gives the classification of cases according to the cardiovascular diagnosis. It is apparent that the great majority had rheumatic heart disease, as would be expected in the childbearing age period. The most frequent valve lesion was mitral insufficiency, which is also the most frequent lesion seen in rheumatic heart disease in general. The 5 cases of potential heart disease all previously had definite rheumatic fever with 4 having been followed in our hospital and 1 having been hospitalized for 2 months in another city. One had previous electrocardiographic evidence of carditis, and all may have had possible carditis. In the absence of a demonstrable valve lesion at the time of our examination, they were classified only as potential heart disease. The congenital group included 2 cases of interauricular septal defect, one case of Eisenmenger's complex, and one tetralogy of Fallot. The miscellaneous group consisted of 4 cases: (1) Two cases of gross cardiac arrhythmia consisting of multiple persistent ventricular (Case A) and auricular (Case B) extrasystoles without other abnormality. (2) One case of 4 plus albuminuria, 4 plus edema, persistent tachycardia (110 to 115) without definite cardiac lesion. (3) One case in which blood pressure was repeatedly 145/0 without demonstrable aortic valve lesion or other abnormality.

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TABLE I

CARDIAC DIAGNOSIS	NO. PATIENTS
I. Rheumatic heart disease	
Mitral insufficiency	13
Mitral stenosis	1
Aortic insufficiency	1
Aortic stenosis	1
Mitral stenosis and insufficiency	1
Aortic and mitral disease combined	1
Aortic stenosis and insufficiency	3
II. Potential heart disease	5
III. Hypertensive heart disease	1
Also had mitral insufficiency	
IV. Congenital heart disease	4
V. Miscellaneous types	4
a. Multiple ventricular extrasystoles	
b. 4 plus albuminuria, and edema with persistent tachycardia (110 to 115) without definite cardiac lesion	
c. Blood pressure repeatedly 145/0 without aortic valve lesion or other abnormality	
d. Multiple auricular extrasystoles	

TABLE II

AGE (YEARS)	NO. PATIENTS	PARITY	NO. PATIENTS
15 to 20	14	Primi.	15
21 to 25	11	Para i	12
26 to 30	3	Para ii	4
31 to 35	5	Para iii	4
over 35	2	Para iv and over	2

Of the entire group, 28 were Negro and 7 were white, which is approximately the normal clinic distribution. Table II shows the age distribution which appears to be normal for the clinic population. It is our impression that the large number in the younger age group (two-thirds under 25 years) may be a factor in the small incidence of maternal complications. Fifteen of those delivered were primigravidae and the remaining 22 were multiparas. In this group, parity seemed unimportant except insofar as an uneventful previous pregnancy indicating adequate cardiovascular function seemed of inestimable value in prognosis.

TABLE III. PERIOD OF GESTATION

DURATION IN WEEKS	NO. CASES
1 to 18	1
18 to 28	2
28 to 38	13
38 to 42	21

Table III discloses over one-third of the patients as having delivered prematurely. Although this is higher than the clinic percentage, no cause is ascribed other than the heart disease. These cardiac patients obtained considerably more adequate prenatal care than the average clinic patient. The usual controllable factors such as diet, vitamin supplements, anemia, and general physical conditions were all within normal limits.

TABLE IV. TYPE OF DELIVERY

Spontaneous	22
Low forceps	8
Midforceps	1
Breech	1
Version	1
Cesarean section	3
Therapeutic abortion	1

Twenty-two patients were delivered spontaneously and 8 by means of low forceps. There was one version in a premature transverse presentation and one breech extraction for a double footling. The midforceps delivery occurred in a patient with prolonged labor who was well sedated. Both the mother and the baby had uneventful postpartum courses.

The three cesarean sections were done for: (1) partial premature separation of the placenta early in labor, (2) funnel pelvis in a primipara who developed congestive failure at 38 weeks' gestation (11 days after the control of the congestive failure, this patient was scheduled for an elective operation as it was felt that a difficult labor superimposed on an impaired heart was too hazardous), (3) interruption of pregnancy at 34 weeks because of severe hypertensive cardiovascular disease.

Since a large percentage of these patients delivered prematurely, depressing drugs were avoided. It was, however, felt desirable to keep the patient as quiet as possible and barbiturates, opiates, and regional anesthesia separately and in combination were used to attain this goal.

TABLE V. TYPES OF ANESTHESIA

Pudendal block	1
Spinal	13
Continuous spinal	2
Saddle block	1
Caudal	3
Gas	6

Some form of regional anesthesia was used for delivery in two-thirds of the cases. While this might be questioned, it was felt that it imposed a much diminished circulatory problem as compared to inhalation anesthesia.

TABLE VI. FETAL RESULT

Live births (2 sets twins)	32
Stillbirths (all premature)	2
Neonatal deaths (all premature)	4

All babies delivered at term, including 2 sets of twins, survived. There were 2 stillbirths, 2 neonatal deaths, and 1 hydrocephalic infant, all among premature babies. Two premature infants that did not survive, and one infant having a congenital anomaly incompatible with life, were the offspring of women having very severe cardiovascular disease: (1) Tetralogy of Fallot, (2) severe mitral stenosis with auricular fibrillation, and (3) aortic stenosis complicated by marked thoracic deformity. It is our impression that, in the severe forms of cardiac involvement, the chance of fetal survival is considerably diminished. The good results in the remaining premature infants are explained only on the basis of improved prenatal care.

In 35 pregnant patients with cardiac disease, the only serious cardiovascular complications were 2 cases of congestive heart failure. In each, there was severe rheumatic heart disease, auricular fibrillation, marked cardiac enlargement, and advanced mitral valve disease. One was a primigravida of 22 years and the other a primigravida of 32 years. Both patients were promptly hospitalized and the congestive failure responded well to the usual methods of treatment. The first developed failure at 38 weeks and was delivered 11 days later by cesarean section. The second was delivered prematurely at 31 weeks of a hydrocephalic stillborn infant. Failure developed 3 days later and was associated with hemoptysis. Both recovered, were discharged from the hospital improved, and returned to the follow-up clinic in a satisfactory condition. In the absence of active rheumatic carditis and with a favorable cardiac evaluation, no patients developed failure without previous warning. Some, however, did better than expected with unfavorable prediction on the basis of initial examination.

We believe it is vital in the management of these patients that they be followed jointly by the cardiac consultant and obstetrical services at each of their normal prenatal visits. This is done to detect in its incipiency evidence of congestive failure, which is the principal, as well as the most serious, complication. At the first evidence of failure, all patients are hospitalized and, where possible, not discharged until after delivery. If this type of care is exercised, we feel that maternal mortality will remain relatively low, in spite of the presence of heart disease. There were no maternal deaths in our entire series.

One therapeutic abortion was performed. This was done in an uncooperative patient with Eisenmenger's complex who had had two previous pregnancies. The first was a spontaneous abortion of twins, and the second a premature delivery of a living healthy baby at 30 weeks. In view of the severe cyanotic heart disease in a 25-year-old patient who already had a living child, it was felt that therapeutic abortion was indicated, together with limitation of future pregnancies. Another such procedure was recommended in a 19-year-old primipara who was seen in the first trimester and found to have severe aortic insufficiency and cardiac enlargement. The patient refused and was followed through delivery without difficulty. After the first trimester, abdominal hysterectomy is often more hazardous than allowing the pregnancy to go to term.

Tubal ligation was carried out in 9 patients, but only in those with the most severe heart disease where limitation of pregnancies was felt to be a definite need. In only 1 instance was this procedure carried out because of grand multiparity.

There were no cesarean sections done primarily for heart disease. We feel that in spite of the heart disease, the type of delivery should be determined mainly on obstetrical indications.

Prognosis, maternal and fetal, seems to parallel the severity of the heart disease. Studies of other groups have substantiated this view, particularly as regards rheumatic heart disease.

### Summary

A group of patients having heart disease and jointly managed by a cardiologist and obstetrician are reviewed. The details of cardiovascular diagnosis, obstetrical management, and maternal and fetal results are given. Suggestions as to principles of treatment are outlined.

The authors wish to express their appreciation to Dr. William B. Porter, Professor of Medicine, and Dr. H. Hudnall Ware, Jr., Professor of Obstetrics and Gynecology at the Medical College of Virginia for their cooperation in making this study possible.

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### Discussion

DR. W. VERNON SKILES, Atlanta, Ga.—Heart disease (90 per cent rheumatic heart disease) now ranks with toxemia of pregnancy as a cause of death in many northern clinics and, in some instances, causes more deaths than toxemia. We are indeed fortunate in this section that the incidence of rheumatic heart disease is so low in the general population.

This paper brings out the importance of the obstetrician and cardiologist working as a team, because the medical management of the patient with heart disease complicated by pregnancy is paramount, except in occasional cases where direct operative intervention must take place along with the general medical care. The classification of the patient into the so-called classes or groups and the prognosis can only be made with the help of a competent cardiologist.

This paper reports 35 patients with heart disease out of 10,038 deliveries, making an incidence of 0.34 per cent. There were no deaths, which is a fine record. The fetal mortality rate was 17.1 per cent, although two sets of twins surviving partially makes up for this in total number of live births. This fetal mortality rate is slightly lower than the 20 per cent usually found in larger series. All term babies survived, causing us to reflect that prematurity is now the biggest factor in fetal mortality and this holds true in heart disease as well.

The incidence of heart disease complicated by pregnancy is 0.5 per cent on the teaching service, Department of Obstetrics and Gynecology of Emory University at Grady Memorial Hospital. This incidence is from a series of 28,021 deliveries since Jan. 1, 1946. The number of cases was 140, and one death occurred making a maternal mortality rate of 0.7 per cent. There were 59 maternal deaths from other causes in this series, revealing the low incidence of cardiac deaths in this section as compared with clinics in the northern states.

I feel that the so-called potential heart disease cases listed by Dr. McCue and Dr. Schelin should not be included in this series. If they really are heart disease, they would all fall into Class I or the favorable group, and, if not heart disease, would unduly influence the statistical analysis. The case described as 4 plus albuminuria, and edema with persistent tachycardia without definite cardiac lesion could better be excluded also.

The percentage incidence of types of cardiac lesions is in line with many other series emphasizing the great importance that rheumatic heart disease (90 per cent) holds in pregnancy. It is interesting that mitral insufficiency is the leading lesion in order of frequency in this series, because Morgan Jones reports mitral stenosis alone as being much

in the majority in his work. Congenital heart disease ranks after rheumatic heart disease usually in order of frequency, but in this series potential heart disease and miscellaneous types have the same incidence.

The management of the cases in this series is well in line with present-day practice and thought. Vaginal deliveries were accomplished in all but 4 cases; 3 of these were cesarean sections and 1 was a therapeutic abortion. The cesarean sections were all done for obstetrical reasons and not for the heart disease alone and this is of prime importance. The case in which cesarean section was done 11 days after control of congestive heart failure was indicated for such management. However, 3 weeks would have been a more suitable time interval, unless the advent of labor had forced the issue.

Also, if the use of gas as reported in 6 cases was nitrous oxide, I would feel that the low oxygen concentration would put too much of a burden on the heart and this would contraindicate its use. Barbiturates may be contraindicated, too, because of extreme restlessness in some cases.

Only two cases had congestive heart failure in this series, giving an incidence of 5.7 per cent. This is much lower than the 17.6 per cent reported by other authors.

One therapeutic abortion was done which seemed well indicated and limitation of future pregnancies was accomplished at the same time. It is interesting that the other patient for whom these procedures were recommended went to term and delivered a living child without difficulty. This is not said in criticism, but only to emphasize the difficulty in evaluating these cases in some instances.

This paper brings out the point that parity is unimportant except to help in prognosis. A multipara with no history of failure, if no deterioration has occurred in the interim, will probably go through pregnancy without cardiac failure again in the great majority of cases.

There are two basic ways advocated to determine prognosis and the course of management in these cases. Bunim classifies the patients according to 1 of the 4 positions or stages the patient is in regarding rheumatic heart disease. Most patients are in the interval or quiescent phase (stage 3) and so are good risks except that, if the disease has been present in the patient 20 years or more, 37 per cent will decompensate in pregnancy. Morgan feels that the history of natural activity with the degree of impairment before the advent of pregnancy is a reliable guide to prognosis and management of these cases. If there is a history of previous cardiac failure in pregnancy, then 89 per cent will repeat during the course of gestation. So the history of failure is the single most important omen of trouble.

Most authors agree that heart size is very important in predicting the outcome of any given case. If the heart is not enlarged over 10 per cent then usually no failure ensues. A history of hemoptysis, increasing dyspnea on mild physical work or rest, and the advent of increasing pulmonary congestion are warnings of impending failure. Advancing age is also a factor in increasing the percentage of cardiac failures. A patient 35 years old or older has more chance of developing congestive cardiac failure.

Mark has found that the pulse and respirations in the first stage of labor are important in predicting the advent of failure. Fifty per cent of patients in the first stage of labor who have a pulse rate of 110 or greater and a respiratory rate of 24 or greater for 45 minutes will end in cardiac decompensation.

The peak load on the heart is at the thirty-second week of pregnancy when the total plasma volume and extracellular fluid volume are at their peaks. The load decreases somewhat as term is approached and this sequence of events has determined the present-day management of pregnancy and labor in that the great majority are allowed to go to term and be delivered vaginally.

The heart has been thought for some time to do 50 per cent more work at the peak load, but the work of Hamilton and of Palmer and Walker indicates that 26 per cent more work is the correct figure.

The normal changes of pregnancy may lead us astray to the erroneous diagnosis of heart disease. So we must not forget that the normal gravida in a majority of cases will have a systolic cardiac murmur and occasional episodes of dyspnea.

DR. CHARLES H. MAUZY, Winston-Salem, N. C.—Dr. McCue and Dr. Schelin are to be congratulated on their excellent results in the management of 35 pregnant women with cardiac disease. Their extremely low incidence of cardiac disease in pregnancy of 0.34 per cent is extremely difficult to interpret. The incidence of heart disease in pregnant white women at the North Carolina Baptist Hospital over a period of 5 years (1946 through 1950) has been 1 per cent (59 cases in 5,687 deliveries). Thirty-nine of these patients had rheumatic heart disease, 9 had hypertensive cardiovascular disease, 2 congenital heart disease, 2 syphilitic heart disease and the remaining 7 were unclassified.

We heartily endorse the procedure which these authors have followed in the prenatal management of their cardiac patients. It is well known that the cardiac patient presents many problems during pregnancy. There is an added physiologic load on the heart during pregnancy which probably falls somewhere between 25 and 50 per cent increase in the cardiac output. This is associated with an increase in plasma volume and a tendency to store water and electrolytes as evidenced by a marked increase in the extravascular water of the body. In addition to this increase in the basal load on the heart, there is some recent evidence indicating that the work response of the heart is exaggerated during pregnancy. Abnormal factors which may add to the burden include the toxemia of pregnancy with its marked increase in cardiac output, infection, and obesity. The evaluation and management of the pregnant cardiac patient must, of course, be based upon these various considerations.

We feel that a number of factors are of help in evaluating the cardiac patient. These include the functional classification of the patient according to the New York Heart Association, the age of the patient, the duration of the disease, history of previous cardiac failure, the presence or absence of auricular fibrillation, and any complicating medical disease. It is important to realize, however, that a cardiac patient can fail at any time.

We agree with the authors that close medical supervision is essential in the proper management of these patients. All of our service patients are followed in our special Obstetrical-Cardiovascular-Renal Clinic with frequent medical consultation. All private patients have the privilege of consultation by our cardiologist. Frequently, our patients are hospitalized early in pregnancy for proper evaluation of their cardiac status. These patients are seen frequently during their prenatal course. Salt restriction and the usual measures are established to forestall the development of possible toxemia. Prompt hospitalization is instituted when there is evidence of excessive water and salt retention, or at the slightest suggestion of incipient hypertension. With the development of respiratory tract infection or infection of the urinary tract, hospitalization is advised. Digitalis is employed for its usual indication, the presence of, or incipient, congestive failure.

We believe that a prelabor rest period of one or two weeks in the hospital is advisable for patients presenting severe cardiac lesions.

We feel that the obstetric management should be based upon consideration of the additional burden of labor in these patients, and the fact that a secondary peak in congestive failure occurs during the immediate postpartum period. Hyoscine should be avoided as an agent for premedication because of the possible excitation that it may provoke.

As with the authors' series, the majority of our patients were delivered under regional anesthesia. Adequate oxygen is advisable during delivery. There were no cesarean sections in our series. We believe that cesarean section should be reserved only for obstetric indications.

It is rather surprising that the majority of the authors' patients were delivered spontaneously as we feel that the use of low forceps is indicated in an effort to shorten

the load of the second stage of labor. We believe with Mendelson and Pardee that the pulse and respiration during labor serve as a reasonably reliable index of impending congestive failure.

Following delivery, the patient should be carefully supervised and watched closely for incipient heart failure. We routinely place our patients in a moderate Fowler's position and oxygen is always readily available.

There were 4 maternal deaths in our series. Two were immediate. The first, a primigravida, 32 weeks pregnant, died undelivered with an Eisenmenger's complex. The second, a 17-year-old primigravida, 36 weeks pregnant, with no prenatal care, was admitted in coma and died in congestive failure with complication of cardiovascular disease 18 hours after delivery. This patient had had a bilateral Smithwick operation performed elsewhere 14 months prior to her pregnancy. The 2 other deaths were remote, one patient dying from cardiac failure due to rheumatic heart disease 6 months post partum and the other from a ruptured aortic aneurysm on a syphilitic basis at 5 months post partum.

DR. McCUE (closing).—Heart disease complicating pregnancy apparently occurs relatively infrequently in our hospital. I feel sure that geographic location has some influence on this. In the childbearing age one expects to find rheumatic heart disease more than any other type. This is true in our series as in other reported groups. The incidence of rheumatic fever and subsequent rheumatic heart disease in the general population is distinctly higher in New England, New York, and North Atlantic states than in Virginia. This variation would obviously be reflected in the study of any special group. We have also attempted to exclude from this series any case having only a functional systolic murmur. There are times when one is entirely dependent upon the cardiologist's opinion as to the significance of the murmur. In a large number of cases of rheumatic heart disease with mitral insufficiency the only positive finding is the characteristic apical systolic murmur. Fortunately, the most commonly observed functional murmur in pregnancy is a short, low-pitched blow localized predominantly at the pulmonic area. This was the only finding present in approximately three-fourths of all patients referred to us for cardiovascular evaluation. I believe this is the usual experience in obstetrical cardiac clinics.

Special studies were done on all patients having or suspected of having any organic heart disease. The electrocardiograph provided limited information in the majority of cases of mitral insufficiency. In those cases having a disorder of rhythm, the cases of advanced mitral valve disease, and in the congenital heart patients it supplied information of considerable assistance. Mitral stenosis was accompanied by the changes characteristic of right ventricular hypertrophy, as were the 2 cases of interauricular septal defect, and the 2 cases of cyanotic congenital heart disease.

Fluoroscopy and/or heart x-ray examination was of greater value than the electrocardiograph in the evaluation of these patients. Rather than employ the American Heart Association functional classification of grades I, II, III, and IV, we have attempted to base our opinion on a total evaluation of the patient: type of lesion present, heart size, arrhythmia, evidence of ventricular preponderance on electrocardiogram, resting pulse rate, cardiac reserve, extracardiac complication, i.e., deformity of the chest, and, of course, any clinical evidence of congestive failure. On the basis of this approach we have found in this series that no patient developed serious cardiovascular complication unexpectedly. In fact, the reverse was true. We predicted early in pregnancy the probability of subsequent difficulty in several cases that went through pregnancy, labor, and the postpartum period quite uneventfully. The presence of auricular fibrillation is an ominous sign. In rheumatic heart disease it usually indicates a relatively advanced lesion, and the two cases in our series having this arrhythmia both developed congestive failure. The one case of Eisenmenger's complex had a previous pregnancy terminating in premature labor with stillborn twins, but without maternal complication. The second pregnancy produced no maternal distress and the premature infant did quite well and developed normally. The

second case of cyanotic congenital heart disease, tetralogy of Fallot, was extremely interesting. The patient was 6 feet tall, had excellent cardiac reserve, and was entirely asymptomatic. This is quite unusual and in the course of our study of this patient I believe we found the explanation. She had 20 Gm. of hemoglobin per 100 c.c. of circulating blood, and her arterial oxygen saturation was 75.6 per cent. This means that she had 15 Gm. of oxygen-saturated blood in the arterial system which would be very satisfactory for any of us. Obviously she was circulating a considerably increased blood volume as compared to normal so that the mechanical work imposed upon the heart was increased; but in the period of our observation she had adequate cardiac reserve and did quite well. She delivered prematurely an infant weighing less than 3½ pounds, and the child survived only about 12 hours. We did not find coarctation of the aorta or patent ductus arteriosus in any patients referred for evaluation. It is my impression that these defects are more frequently seen with pregnancy than the cyanotic types of congenital cardiovascular defect. Coarctation of the aorta impresses me as a cardiovascular indication for cesarean section, and is probably the only such instance.

Physiologic studies of the circulation during pregnancy have shown that the average cardiac output is from 10 to 25 per cent above the nonpregnant state. There is a gradual increase in output from about 12 weeks to approximately 28 to 32 weeks, and a gradual fall after 36 weeks. This variation in output roughly parallels the change in blood volume. As the placenta develops, the situation becomes somewhat analogous to an arteriovenous fistula. In the latter weeks of pregnancy apparently the placenta becomes more a reserve pool and this may explain the drop in both maternal blood volume and cardiac output. Labor itself imposes a varying amount of work on the mother that can at times be hard physical work. It has not been our experience, nor that of other investigators, that cardiovascular difficulty develops right in labor, but does sometimes appear in the early postpartum period and I feel that such occurrence is definitely related to the exertion of labor.

In conclusion, I should like to say that if cardiac evaluation is made during the first half of pregnancy adequate prediction and preparation may be made as regards maternal difficulties. Some patients will do considerably better than one might expect, and those women having only mitral insufficiency with a normal-sized heart and good cardiac reserve may be regarded as functionally normal. The over-all maternal mortality should remain relatively low. As regards the fetal result we felt much less able to predict the influence of a cardiovascular complication. The fetal mortality is certainly substantially increased apparently because of the greatly increased occurrence of premature labor in these patients.

## TRICHOMONAS VAGINALIS DONNÉ\*

### An Evaluation of Experimental and Clinical Data

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(From the Dade County Cancer Institute)

CYTOTOLOGY studies reveal that a high percentage of slides classified as Grade I (inflammatory) Ayre's classification show evidence of a *Trichomonas vaginalis* infection. A study of slides on 501 cases examined in the cytology laboratory of Roosevelt Hospital, New York, gave the results shown in Table I.

TABLE I

GRADE	NO. CASES	TRICHOMONAS	PER CENT
0	338	67	19.8
I	133	74	55.6
II	8	1	12.5
III	16	6	37.5
Questionable	6	0	0
Total	501	148	29.5

From Dade County Cancer Institute's Cytology Diagnostic Division, there was less evidence of *Trichomonas vaginalis* infection. In a review of 500 general cases, the results were as presented in Table II.

TABLE II

GRADE	NO. CASES	TRICHOMONAS	PER CENT
0	386	18	4.6
I	100	18	18.0
II	4	0	0
III	10	1	10.0
Total	500	37	7.4

A study of 500 cases from Clinical Services at Jackson Memorial Hospital, Miami, showed the results presented in Table III.

TABLE III

GRADE	NO. CASES	TRICHOMONAS	PER CENT
0	330	53	16.0
I	138	51	36.9
II	20	3	15.0
III	12	0	0
Total	500	107	21.4

It is evident that fewer women have a *Trichomonas vaginalis* infection in the Miami area. A group of 538 women personally examined by one of us (C. H. D.) in a cancer detection clinic showed only 20 women, or 3.72 per cent, with evidence of the *Trichomonas vaginalis*.

\*Presented at the Fourteenth Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Clearwater, Fla., Jan. 24 to 26, 1952.

It is not suggested that these flagellates will prove to be a major factor in the development of cervical cancer but, by keeping up a chronic irritation, it is quite possible that they may help produce the metaplastic changes in the cervical epithelium that occur in the shift from the normal to the malignant. It is, therefore, believed important to undertake a further investigation of the *Trichomonas vaginalis* Donn   along with cell behavior studies of the early changes in the cervical cells that precede clinical cancer of the cervix uteri.

Trussell, in his monograph *Trichomonas Vaginalis and Trichomoniasis*,<sup>1</sup> has reviewed the very extensive literature covering both experimental and clinical data. It is evident that many of the data are unconfirmed or conflicting. Gradually, we are rechecking much of the experimental data preliminary to undertaking a somewhat detailed study of the physiology and life cycle of this interesting organism. In the present communication, some of the data will be reviewed briefly, then our present attitude toward the desirable types of treatment will be discussed.

### Experimental Data and Clinical Observations

Notwithstanding the many studies reported in the world literature, the life cycle of the *Trichomonas vaginalis* Donn   remains a mystery. A few observers believe that they have evidence to prove that the vaginal form may develop from the *Trichomonas hominis*, but for the present the evidence must be doubted. Hees, in his 1938 report,<sup>2</sup> offers evidence to suggest that *Trichomonas vaginalis* may develop from the *T. genitalis bovis* as an irreversible and autolytic deviation from the fundamental pathogenic form as observed in the blood and intestines of man, cattle, horses, dogs, cats and pigs. He administered orally, several times during one week, *T. genitalis bovis* to an inoperable cancer patient who had been previously checked very carefully for *Trichomonas vaginalis*, and she developed a generalized *Trichomonas* infection with the appearance of the *Pentatrichomonas ardin delteili*—*T. hominis* group in blood and stools at the end of the following week, and *Trichomonas vaginalis* in the vaginal discharge after a fortnight. Experiments of this type confirming the Hees findings are not available, and for the present his report must be listed as unconfirmed.

Many types of culture media have been employed in cultural studies of *T. vaginalis*. Davis and Colwell, in 1929,<sup>3</sup> found that human blood serum was essential to active growth of this flagellate. Both Locke's solution and glucose broth to which fresh human serum had been added proved satisfactory, with a pH that ranged from 5.1 to 8.5. It was necessary to transfer to new media every two or three days since there was a gradual drop in the pH and following exposure to a pH below 5 the flagellates died. Working with a pure culture Trussell and associates reported that blood serum other than human could be used. Davis and Colwell did not get growth or prolonged survival when they tried blood serum from the usual laboratory animals, but they did not work with pure cultures. One of us (C. G. G.), in recent checks, has found that growth occurs in media with the pH varying from 5.5 to 8.5. Human blood serum was used in these checks, and thus far he has not tested the serum from other animals.

It is evident that *T. vaginalis* will survive much longer when the culture tubes are kept at room temperature than when a temperature of 37° C. is maintained. However, this depends upon the change in pH, the growth of the organisms being much more rapid in the incubator with a resulting rapid drop in the pH and a resulting damage to the organisms as soon as it drops below 5.

Since the development of antibiotics, all of which may be used to destroy bacteria, it has become relatively easy to secure bacteria-free strains of *T. vaginalis* provided there is not an associated yeast. A mixture of penicillin and streptomycin is the one most frequently employed. Aureomycin hydrochloride which has a pH of 3.5 cannot be used since the acidity kills the flagellates. However, when this antibiotic is added to culture media and the pH buffered up to 6 or 7, the flagellates are not harmed. This, of course, suggests that the clinical results reported from use of Aureomycin in the treatment of *Trichomonas vaginalis vaginitis* probably resulted from the acidity of the product rather than any special effect of the Aureomycin.

Very little is known regarding the possible survival of *T. vaginalis* under unfavorable circumstances. Difficulties in growing these organisms in cultures must make one skeptical regarding the claims of those who report successful subcultures after letting vaginal secretions dry in the air for several hours. For the present we must consider these claims unconfirmed.

Under unfavorable conditions *T. vaginalis* organisms lose their normal shape and appear as spheres. This is noted in old cultures where the pH has dropped below 5. It is also noted if a culture tube is placed in the refrigerator overnight. However, when the temperature is gradually raised it will be observed that the flagella gradually unfold and eventually the organism resumes its normal shape. It would appear that the spherical form is developed in an attempt of the flagellates to survive under an unfavorable condition. Clumps of the organisms also may be observed, suggesting that an attempt is being made to protect some organisms against destruction by enclosing them in a protoplasmic mass. It is still uncertain as to whether or not true cysts are ever formed.

Laboratory tests of various agents suitable for clinical use are essential and they may be made in two ways. First, different concentrations may be added to culture media in which the pH can be maintained within a range in which the *T. vaginalis* will grow. Second, checks may be made by mixing various agents with culture material in a hanging drop and observing the effect on the flagellates by means of the microscope. Obviously both should be employed in making an evaluation of any drug to be used clinically. It is also important to evaluate the action of any medication upon the vaginal mucosa, for presence of mucus and pus or other albumin may affect the action of many drugs. Furthermore, in treatment care must be taken to avoid further damage to an already inflamed vaginal mucosa. Using these precautions, it is evident that many medications suggested as more or less specific trichomonicides are of little value and some may be contraindicated. MacDonald and Tatum, in 1948,<sup>4</sup> reported on 103 drugs, many being of no value. Trussell, in his monograph, also provides a long list of compounds which kill *T. vaginalis* quickly in an acidity and protein content somewhat comparable to the vaginal discharge. He also lists many that are of little or no value. It has not been possible for us to check all of his results, but contrary to his report we found that Zephiran Chloride would kill our organisms in very high dilutions although this did not kill the bacteria in our contaminated cultures. To our surprise, one of the commonly used surgical soaps did not kill the Trichomonas even in low dilutions.

It is evident that an attempt must be made to fathom the life cycle of the *T. vaginalis*. Under the supervision of Dr. Robert Chambers, our studies will be continued, and by means of the micromethods that he has developed, it is hoped that additional useful data may be obtained.

### Diagnosis and Treatment

Diagnosis of a *T. vaginalis* infection is easily made by examining, under the low power of the microscope, fresh material obtained from the posterior

vaginal fornix and diluted on a slide with normal salt solution. This is best done in the examining room. However, there is little chance of finding the flagellates if the patient has douched within twenty-four hours. The *T. vaginalis* should be suspected whenever there is an irritating leukorrheal discharge.

Treatment presents a variety of problems. Various types of treatment have been advocated, and with many of them cures have been obtained in 80 or 90 per cent of cases within a few weeks or months. Relapses occur but, through continued effort, one may expect to cure practically all women with few exceptions who will keep under observation and follow directions adequately. This statement is based upon experience with 400 office patients treated over an eight-year period. Many types of treatment have been tested, but no drug has been found to be "specific," and no form of treatment has been universally satisfactory.

The *Trichomonas vaginalis* is readily killed by practically all of the antisepsics in common use. Tinctures should be used cautiously since the alcohol and acetone, while very effective against the flagellates, also act as irritants to the vaginal mucosa. Aqueous solutions of Merthiolate, Metaphen, Mercurochrome and Zephiran Chloride are suitable for cleansing the vaginal mucosa in office practice. In our recent checks in vitro, Zephiran Chloride appeared to be effective in far greater dilutions than any of the others listed. Through careful washing of the vagina with aqueous solutions of any of these preparations, using the strengths commonly employed, it should be possible to kill all of the flagellates free in the vaginal secretions. We know that the *T. vaginalis* is capable of burrowing deeply into the roughened surface of the vaginal and probably the cervical mucosa, where the albumin normally present acts to protect many of the organisms from surface medication. Accordingly, an effort should be made to use antisepsics in a strength that will not coagulate albumin and thereby prevent penetration into roughened mucosal surfaces. Following a thorough cleansing of the entire vagina, some substance capable of killing the flagellates, while not causing a local irritation, should be introduced. Various tablets, suppositories, creams, and greaseless jellies have been marketed for home use. Many patients have found it difficult to introduce tablets and suppositories into the vaginal vault and our preference is for a medicated vaginal cream or jelly that may be introduced with a syringe. Then, if the woman will introduce one of the cotton tampons available in individual containers, there is little or no escape of the cream or jelly which will spread over the entire vaginal mucosa. Many of the medicated acid preparations sold for contraception should be useful in the treatment of *T. vaginalis* vaginitis<sup>5</sup> (for composition see J. A. M. A., January 5, 1952, Vol. 148, Pg. 50). In the morning the patient removes the tampon and douches, using 3 or 4 tablespoonfuls of vinegar in a quart of tepid water. A reclining position is necessary and to insure low pressure a return-flow type of douche tip is desirable. Whirling sprays provide too much pressure and may be dangerous, especially for a pregnant woman. During menstruation the patient is instructed to douche twice daily since the presence of menstrual blood favors a rapid multiplication of any flagellates that may remain.

Medicated powders blown into the vagina through a speculum have been of definite value in office treatment, but may be dangerous if introduced under pressure and accordingly cannot be advised for home treatment. Introduction of a tampon following use of a powder apparently aids in its distribution over the surface of the vagina. The drying effect of kaolin definitely interferes with the growth of the flagellates and it has been a common vehicle for introduction of many different drugs, some of which probably added nothing to the basic value of the kaolin.

A healthy vaginal mucosa is necessary in the final cure of the woman who has *T. vaginalis*. Karnaky<sup>6</sup> (*Texas Record and Annals*, May, 1936) has used glucose in his treatment in an attempt to restore the normal acid-producing bacilli of Döderlein. Brady and Reid<sup>7</sup> used *Lactobacilli* as a means of restoring the normal vaginal flora, this organism being culturally identical with the acid-forming bacillus normally found. Obviously, this is an important phase of the treatment for it is recognized that the pH of a normal vagina other than during menstruation, and perhaps in the posterior vaginal fornix where the alkaline secretion from the cervical glands lessens the acidity, is unfavorable for growth of the *T. vaginalis* Donne.

Patients with acute *T. vaginalis* vaginitis commonly have a mixed bacterial infection in addition to the flagellates. We have found an organism in one of our cultures that causes an alkaline reaction in culture media and it is possible that an alkaline-producing bacterium may contribute to the continued growth of the *T. vaginalis* which would normally be killed by the usual acidity of a healthy vagina. Thus far this organism has not been identified.

Aureomycin hydrochloride has been recommended for treatment of *T. vaginalis* vaginitis by several clinicians during the past year. Our laboratory checks indicate that the action of this antibiotic probably results from its marked acidity, the pH being 3.5. Vaginal preparations containing aureomycin have not provided a higher percentage of apparent cures than may be obtained by other available preparations. The reports of severe yeast infections following the use of aureomycin should discourage anyone who has been confronted with treatment of fungus infections. It may be more difficult to cure the yeast vaginitis than the one caused by the *T. vaginalis*.<sup>8, 9</sup>

Less than thirty years have elapsed since our first real attempts to diagnose the cause of leukorrhea were started. So long as everyone depended upon stained smears, very few cases of *T. vaginalis* vaginitis were diagnosed. With the introduction of the wet smear, we soon recognized that most of our patients with recurring cases of leukorrhea had a Trichomonas infection. But in our constant search for better methods of treatment, it should be recalled that for many years previously, most cases of leukorrhea were successfully treated by means of Iethyolglycerine tampons and medicated douches that contained either mercury bichloride, Formalin, liquor cresolis saponatus, tincture of green soap, potassium permanganate, or iodine in appropriate strengths. Silver nitrate also was commonly used in office practice. Every one of these, with the possible exception of Iethyol, has been demonstrated to be among our most effective trichomonicides.<sup>3, 10</sup>

Today we understand better the nature of the *Trichomonas vaginalis* infection and appreciate the need for daily treatments over a variable period of time. Newer pharmaceuticals have facilitated the necessary home treatments, but it is probable that just as high a percentage of cures may be obtained by the old Iethyol-glycerine tampons and the douches at home with any of the drugs listed above.

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### Discussion

DR. MILLARD B. SAVAGE, Norfolk, Va.—I am going to limit my discussion of this paper to a practical or even critical attitude, thinking and reasoning along the lines of the patients, and what we and they know of this disease.

*Trichomonas vaginalis* infestation is a gynecological problem of long standing, and after more than a century of observation and treatment, since its discovery by Donn   in 1836, it still remains one of our truly nuisance diseases. Its prevalence among women—1 in 5—today, appears to me to be as great as, if not greater than, it was many years ago when I first saw it in a hanging-drop slide. Dr. Davis and Dr. Grand are to be congratulated upon bringing us the present-day status of what I think of as my alibi—or disease—dilemma number one.

The gynecologist needs an alibi when he begins to describe it as a parasite or an organism which infests the vagina and causes most disagreeable symptoms in one patient and not in another; when he says that it can possibly come from the rectum where it lives without symptoms and that cleansing forward spreads the infection, and backward does not spread it, that we are not sure where it comes from, but that after curing it, we are not sure it will not return from the same place next month or next year, or that it could have been contracted from another woman, a man, a douche bag, a toilet, or from lack of cleanliness.

I find the disease among patients of the higher economic strata, many of whom have read numerous articles in the literary magazines concerning this condition, and they readily identify it when the diagnostic name is stated. They will tell you that it is the same condition which was diagnosed by a physician or clinic, and treated several months or years ago, either near by or in a far distant city.

The patient accepts your treatment, particularly if it is different from the one used before, gets relief, eventually discontinues her treatment and believes that she is cured again, until the condition recurs and the cycle continues on. She learns that the parasite can hide out in the folds or mucosa of the vagina, in the cervical canal, the uterus, possibly in Bartholin's glands, Skene's glands, the urethra, the bladder, and even farther away in the genitourinary system.

Undoubtedly in the past and where laboratory study was not available, the gram-negative specific diplococcus got credit for the pathological invasion of the female genitalia, and owes the trichomonas organism an apology for mistaken identity. Now we hear it is spreading to men and should be known as the seventh venereal disease. I rather hesitate to tell a woman that it can come from a man, particularly if she does not happen to be married.

There is confusion among many of the chronic patients and many of them develop a cancer phobia or even a psychoneurosis after a period of years. To me it was small wonder that one of my patients swallowed the tablets by mouth instead of inserting them per vaginam. After that, I discontinued anything poisonous, or containing arsenic, for use in the treatment per vaginam. Perhaps as you think of it, a specific for this condition may have to be taken by mouth together with local treatment to finally eradicate it.

In closing, I would like to state that the fact that there are so many different and routine treatments that everyone has used, and the fact that these modes of treatment are being repeatedly changed by many is proof positive that we do not have a specific cure for this disease at the present time.

The treatments in use by almost everyone give such relief as to keep the patients comfortable and the doctor, perhaps, satisfied, and they do help prevent many complications which can result from nontreatment of this condition.

My own experience has led me to believe that my best results have been obtained by long-continued treatment, rather than by any particular medication.

I also feel that the criterion of cures is not standardized at the present time, and that we would do well to re-examine our data and facts in estimating a percentage of our cures. Until we have a specific treatment, further experimentation and evaluation of clinical data, such as that which is being done by the authors of this timely paper, will have to be carried on.

DR. JAMES R. SORY, West Palm Beach, Fla.—During the past twenty-five years intensive research has failed to provide a completely satisfactory therapeutic agent.

It was of interest to note in the opening paragraphs that half of the slides for cytology study done at Roosevelt Hospital in New York classified as Grade I cells and more than one-third of those classified Grade III cells showed evidence of a *Trichomonas vaginalis* infection. During the past two and one-half years I have taken vaginal and cervical smears on 460 patients. A small percentage of these patients had a positive smear for *Trichomonas vaginalis* but on a majority of the patients no smear for Trichomonas was taken. In a large majority of the results of the smears no cancer cells were found but *Trichomonas vaginalis* was present. This should certainly make each of us stop and think how important it is to make a correct diagnosis of any vaginal leukorrhea and treat it properly.

As to the etiology of *Trichomonas vaginalis* much research work has been done and many theories employed. To date the life cycle of the Trichomonas remains a mystery but it is hoped that further study will develop additional data of importance.

In regard to treatment as stated by Dr. Davis and Dr. Grand, many drugs have been employed but none have been found to be specific and some contraindicated as they may cause further damage to an already inflamed vaginal mucosa. Good results were obtained by the treatment outlined in the paper, with 80 to 90 per cent of the patients cured.

During the past three months (thanks to Dr. Robert F. Greenblatt) I have treated six cases of *Trichomonas vaginalis* by vaginal insufflation of a powder containing Aureomycin 1.0 Gm., talc 3.5 Gm., methylparaben 8 per cent and propylparaben 2 per cent. Vaginal insufflation has been done every other day for five consecutive treatments and then once a week for five weeks. The pH of the powder was 4.5 and only one patient had a positive smear for fungus following the third or fourth treatment and all had negative smears for *Trichomonas vaginalis*. This course of treatment is being continued at the present time. The series is too small to provide a basis for conclusions, but I did want to make mention of it.

Regardless of the treatment or the drug employed the final result is to obtain a healthy vaginal mucosa.

DR. BAYARD CARTER, Durham, N. C.—Dr. Davis has given a stimulating review of some of the problems which arise in the consideration of *Trichomonas vaginalis* infection.

The opening paragraphs of his paper bring forth the suggestion that more work be done in the investigation of this type of infection in its relationship to the early changes in the cervical cells that precede clinical cancer of the cervix uteri. It is with this section that this discussion will deal.

For years we have been trying to raise funds to make possible a concomitant accurate study of the bacterial flora of the vagina and cervix and the type of cells found by the techniques of exfoliative cytology. Thus far neither we, nor anyone else, have been able to forward this type of complete study. Certainly a study by accurate and complete aerobic and anaerobic methods of the various organisms found in the vagina and cervix would in itself be a tremendous undertaking. To add to this study simultaneous complete exfoliative cytology studies would double the responsibility. This work should be done. Dr. Davis states that in Ayre's studies in exfoliative cytology, more than half of the slides classified as Grade I (inflammatory), and more than one-third of the slides showing Grade III cells also showed evidence of *Trichomonas vaginalis* infection.

In 1948, Kernodle and Cuyler in our clinic reported in the *Southern Medical Journal* that 13 (18.3 per cent) of 70 gynecologic cancer patients were found to have *Trichomonas vaginalis* infection. These 70 malignant tumors were found in 327 postlimaeteric women. In these 327 women, 23 per cent were found to have *Trichomonas vaginalis* infection.

In our studies of 915 pregnant patients, 21.1 per cent had *Trichomonas vaginalis* infection. Of these 915 patients 15.1 per cent had cervical lesions (including intraepithelial carcinoma) of the cervix. However, not all patients who showed these lesions by carefully controlled exfoliative cytologic techniques had *Trichomonas vaginalis*. It is realized that *Trichomonas vaginalis* infections are noted more often during pregnancy. In 2,937 pregnant

patients 22 patients had intraepithelial carcinoma of the cervix, an incidence of 0.75 per cent, whereas the incidence of intraepithelial carcinoma in all patients studied who did not have invasive cancer was 0.72 per cent.

More Negro patients are seen in our department than white patients. More Negro patients have *Trichomonas vaginalis* infections than do white patients.

Of 148 intraepithelial carcinomas of the cervix studied, only 42 (28.4 per cent) were in Negro patients. Of 549 invasive squamous-cell carcinomas of the cervix studied 266 were in Negroes and 283 in white patients.

When last our fragmentary knowledge was brought up to date on Dr. Papanicolaou's work, he and Terzano had not been able, in a large number of patients, to make any significant correlations between the presence of *Trichomonas vaginalis* and the existence of cancer.

According to our pathologists, approximately 90 per cent of the cervices subjected to biopsies in our daily routine of work show endocervical metaplasia. It is significant that we can, as a rule, prove *Trichomonas vaginalis* infestation in only 35 per cent to 40 per cent of these patients.

Certainly experience in exfoliative cytology proves that there are changes seen in the cytoplasm and nuclei in exfoliated cells when *Trichomonas vaginalis* infections are present. The question of whether the changes noted in the exfoliated cells would be compatible with early neoplastic changes is as yet not answered. Certainly in looking at the histologic sections taken from the tissues removed from these cervices and endocervices we cannot say that the nuclear changes in any way suggest neoplastic changes. It is also completely reasonable to think that therapy with various agents and antibiotics may reverse these changes seen in preparations.

We will await with true interest Dr. Davis' critical review of the experimental data on *Trichomonas vaginalis* Donn   and his study of its physiology and life cycle.

## **TRANSPLANTATION OF EXTERNAL OBLIQUE APONEUROSIS: AN OPERATION FOR PROLAPSE OF THE VAGINA FOLLOWING HYSTERECTOMY\***

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**S**CHUBERT<sup>1</sup> in 1914 stated that the multiplicity of methods advocated for the treatment of uterine prolapse attested to the inadequacy of any one operation. Thirty-six years later the editor of the *Year Book of Obstetrics and Gynecology*<sup>2</sup> reiterated this, as many others had done meanwhile. The treatment of prolapse of the vagina, with or without the cervical stump, following hysterectomy has been equally varied and the results less satisfactory. It is even more demanding of the resourcefulness of the surgeon.

When the cervix is present in cases of prolapse, the preference of most operators, including the authors, has been the utilization of the supporting structures from below, such as modification of the Manchester operation or the interposition of the cervical stump after the method of Watkins. When the cervix has been removed, however, operation by the vaginal route may be more difficult. Miller<sup>3</sup> has entered the peritoneal cavity through a posterior colpotomy and anchored the vaginal vault to the uterosacral ligaments. Colpocleisis after the method of LeFort is occasionally done. This is usually reserved for the very elderly or infirm woman in whom preservation of sexual function is of no great importance. Goodall and Power<sup>4</sup> have attempted to extend the scope of colpocleisis to the younger woman with some degree of success. Of course the commonly associated cystocele, relaxed urethra, rectocele, and enterocele must receive due consideration in the management of any patient.

Regardless of how desirable the operation from below may be, one not infrequently, either alone, or in addition to vaginal procedures, must resort to the abdominal approach to secure adequate support. Various methods of ventral fixation have been described. Ward<sup>5</sup> used preserved ox fascia to suspend the vaginal vault from the anterior abdominal wall, the strips being passed subperitoneally over the bladder. Brady<sup>6</sup> merely anchored the vagina to the anterior abdominal wall with braided silk sutures, reinforcing this with the plicated round ligaments.

Harris<sup>7</sup> used the long tendon of the psoas minor muscle on each side when the uterosacral ligaments were so attenuated as to be unsatisfactory. The tendon was divided from its insertion into the pectenial eminence, dissected upward, and drawn under the iliac vessels and anterior to the ureter to be

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attached to the posterior surface of the cervix. This would appear technically rather formidable to the average gynecologist, although the tissues utilized are strong and the direction of traction seems ideal. Schubert,<sup>1</sup> in the treatment of uterine prolapse, utilized the linea alba which he split in halves and left attached near the symphysis. He carried these strips through the abdominal wall lateral to the rectus muscles and thence subperitoneally over the bladder and through the posterior surface of the broad ligaments to be attached to the posterolateral surfaces of the cervix. He later used a free strip of external oblique fascia in a similar manner. Shaw<sup>8</sup> has applied Schubert's principles to the treatment of prolapse of the vagina, carrying the fascial strips from the linea alba retroperitoneally to and through the broad ligaments to be brought together and sutured to the vaginal vault or cervical stump.

In 1949, the authors were faced with the problem of a woman who had a complete inversion of the vagina following subtotal hysterectomy, and on whom there had been two previous attempts at repair from below. The vagina was so scarred, shortened, and narrowed as to discourage any hope of successful treatment from below or ventral fixation from above. The uterosacral and other ligaments were so attenuated that they could not be utilized. It occurred to us that strips of external oblique aponeurosis with the muscle belly attached could be carried through the abdominal wall, thence extra-peritoneally along the course of the round ligaments to be sutured to the lateral fornices of the vagina or to the cervical stump. This procedure seemed logical because nature always employs muscle in supporting structures. Even the dense ligaments in the skeletal articulations serve merely to limit motion, receive muscle attachments, etc., the actual support being the regional muscles. Furthermore, the direction of traction of the musculofascial band appeared to be correct and the complete function of the transplanted structures would be preserved because the attached muscle belly would have an unaltered nerve and blood supply. Since this patient (Case 1) was operated upon, six additional patients with prolapsed vaginal vaults following hysterectomy have been successfully treated.

### Technique

The vaginal vault is elevated by packing the vagina tightly with gauze, leaving the end long so that it can be removed during operation without disturbing the drapes. A Pfannenstiel incision is made through the skin and subcutaneous tissues from a point about 3 cm. medial to the anterior superior iliac spine to a similar point on the opposite side. The external oblique aponeurosis is cleaned carefully for a space at least 3 cm. wide throughout the length of the incision. A strip of the external oblique aponeurosis 1.5 cm. wide is dissected free, the inferior margin of which must be carefully determined so that it splits the fibers of the aponeurosis about 1 cm. above the border of the external inguinal ring. The strips are then detached from the linea alba and laid aside, leaving them attached to the muscle belly laterally (Fig. 1). The medial portions of the strips will, of course, contain reinforcing fibers from the internal oblique. The Pfannenstiel incision is next completed and the rectus muscles are retracted laterally. The apex of the previously packed vagina is identified and pulled up with a figure-of-eight traction suture, after which the vaginal pack is removed. Using a large Kelly clamp, the abdominal wall is perforated at the attached ends of the fascial strips, which should be slightly above the abdominal inguinal ring. The tip of the clamp is insinuated between the leaves of the broad ligament along the course of the round ligament. The peritoneum is perforated at the lateral fornix

of the vagina and the tip of another Kelly clamp is grasped and drawn back through the tunneled path to the perforation in the anterior abdominal wall (Fig. 2). With this second clamp the free end of the fascial strip is grasped and drawn extraperitoneally to the lateral fornix of the vagina and attached

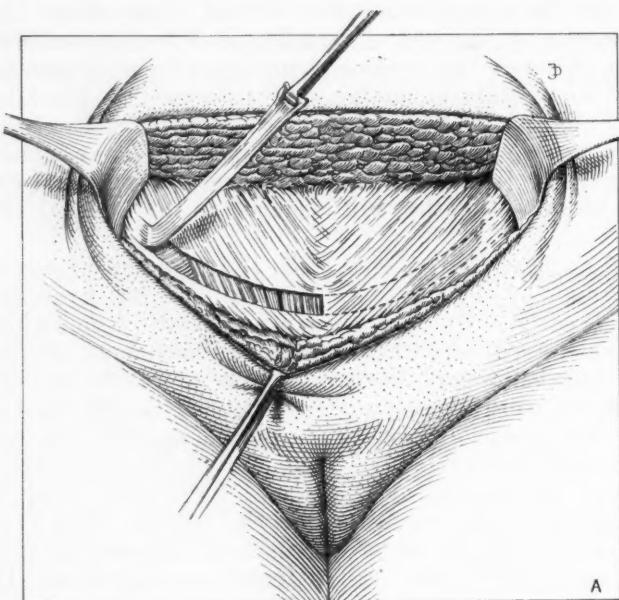


Fig. 1.—A transverse incision has been made through the fat, and a suitable area of fascia has been cleaned of fat. One fascial strap has been dissected free. (From Te Linde, R. W.: *Operative Gynecology*, ed. 2, Philadelphia, 1952, W. B. Saunders Company.)

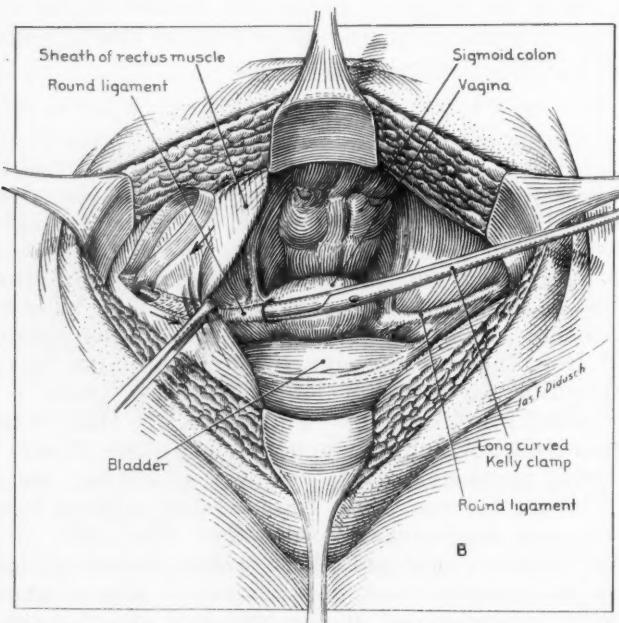


Fig. 2.—A tunnel is made through the leaves of the broad ligament beneath the round ligament. The muscles are perforated with the tip of the clamp, and the end of the strap is grasped. (From Te Linde, R. W.: *Operative Gynecology*, ed. 2, Philadelphia, 1952, W. B. Saunders Company.)

thereto with interrupted sutures of medium fine silk (Fig. 3). When this is repeated on the opposite side, a musculofascial sling is formed which pulls the fornices of the vagina upward and laterally (Fig. 4). Enterocele of any degree should receive adequate attention at this time. Closure of the abdominal wound completes the operation and for this we prefer interrupted fine silk. No difficulty has been encountered in closing the defect left by the excised strip of fascia.

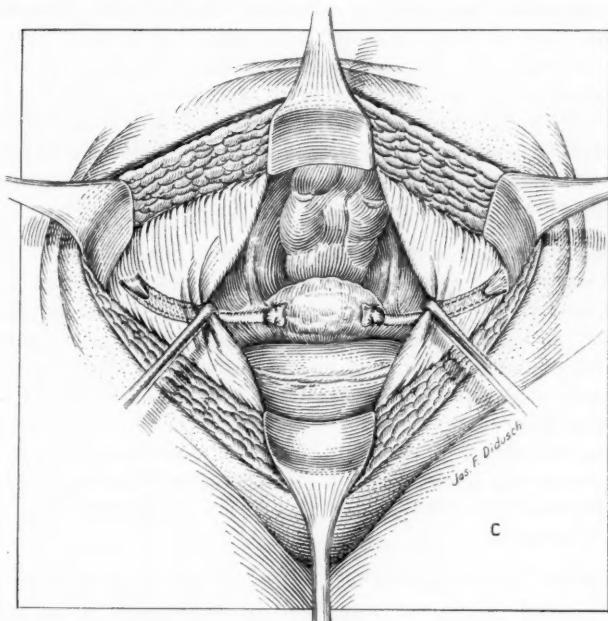


Fig. 3.—The fascial straps have been drawn between the leaves of the broad ligaments, and sutured to the corners of the vagina. (From Te Linde, R. W.: Operative Gynecology, ed. 2, Philadelphia, 1952, W. B. Saunders Company.)

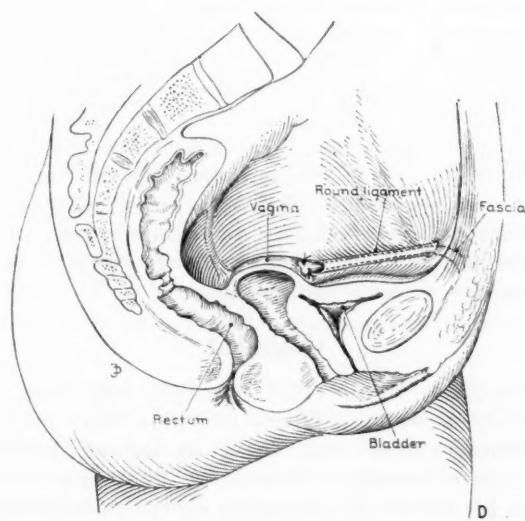


Fig. 4.—Sagittal view, showing mechanism by which the vagina is held in place. (From Te Linde, R. W.: Operative Gynecology, ed. 2, Philadelphia, 1952, W. B. Saunders Company.)

### Case Reports

CASE 1.—(W15131) A 49-year-old white gravida ii, para ii, was admitted with the history of having had supracervical hysterectomy with bilateral salpingo-oophorectomy in 1936. In 1938 she had noted protrusion of the cervical stump from the introitus. In 1947 a partial colpoeleisis was done which cured the prolapse, but due to inability to have intercourse she was operated on again by the same surgeon in 1948, at which time the colpoeleisis was taken down and some other attempt made to repair the prolapse. Immediately after this second operation, the prolapse recurred. Examination disclosed complete prolapse of the vagina with a small atrophic but otherwise normal cervical stump. The vagina was short and markedly diminished in diameter. On Aug. 17, 1949, suspension of the vagina and cervical stump, utilizing strips of attached aponeurosis of external oblique, was done, together with repair of a left indirect inguinal hernia and perineorrhaphy. She has been followed for 30 months and the vaginal vault is well suspended. The vagina has increased about 3.5 cm. in depth with a noticeable increase in width of the fornices. Intercourse was said to be normal and satisfactory.

CASE 2.—(228973) A 42-year-old white gravida i, para i, was admitted complaining of prolapse of the vagina and stress incontinence of urine. Total hysterectomy with bilateral salpingo-oophorectomy had been performed for carcinoma of the corpus uteri in 1945. Approximately two years later she had noted a mass protruding from the introitus. Examination revealed complete protrusion of the vaginal vault with apparent large cystocele. There was only slight perineal relaxation. On replacement of the vaginal vault with a tenaculum the apparent cystocele disappeared. On Sept. 7, 1950, suspension of the vagina with transplanted strips of aponeurosis of the external oblique with appendectomy and Kelly urethroplasty was performed. Fifteen months after operation the vagina was well suspended; there were no cystocele and no urinary symptoms. Sex relations were said to be normal and satisfactory.

CASE 3.—(W18578) A 55-year-old white gravida viii, para vi, was admitted with the complaint of her "bladder falling out" and inability to engage in sex relations because of "short birth canal." Widowed in 1945, she had recently remarried. She gave a history of vaginal hysterectomy with anterior and posterior colporrhaphy in 1946. There was marked symptomatic improvement until one year before admission, when she had a return of the sensation of bladder pressure and noted a mass protruding from the vagina. Examination disclosed complete prolapse of the vagina. When it was replaced, there was neither cystocele nor rectocele, but the vagina measured only 6 cm. in depth. There was slight atrophy of vaginal mucosa. On June 11, 1951, suspension of the vagina was done with strips of external oblique aponeurosis. Some difficulty was encountered due to the marked shortening of the vagina which made its intra-abdominal identification difficult in spite of packing before operation. As a result, the strips were under rather marked tension. It was hoped that this tension would gradually lengthen the vagina and the patient was placed on intravaginal estrogens to make the tissues more elastic. Six weeks after surgery the vagina was well suspended, measured 9 cm. in depth, and the patient was asymptomatic. Contrary to instructions, she had already resumed sex relations and reported coitus to be satisfactory. There has been no recurrence to date.

### Comment

The seven patients on whom this technique has been employed have had uniformly satisfactory results. Three of them had prolapse following abdominal supracervical hysterectomy; three, abdominal total hysterectomy, and one, vaginal total hysterectomy. The three groups presented no particular differences in either problems of technique or the results obtained. A gratifying observation made in each patient is that the slips of muscle belly left attached to the aponeurotic strips retained their function and the vaginal vault

was drawn upward when the patient strained. The two patients with pronounced shortening of the vagina both showed increase in length and widening of the fornices due to the pull on the attached strips. There has been no postoperative morbidity. The only undesirable effect noted was that six of the seven patients complained postoperatively of pain in the groins. This persisted in one patient as long as eight weeks but was not severe in any patient. The longest period of observation has been two and one-half years and the shortest, ten weeks. Obviously these patients will have to be followed for much longer periods of time before the ultimate value of the procedure is determined.

### Summary

Prolapse of the vagina, with or without the cervical stump, after hysterectomy is a condition which requires the surgeon to have at his disposal several different procedures to be applied to the individualized patient. A new procedure, transplantation of strips of the aponeurosis of the external oblique with the muscle belly left attached, is described. The operation is technically simple and has been applied satisfactorily to seven consecutive unselected patients. The series of cases is admittedly small, but the uniform success of the procedure through the relatively short follow-up period and the simplicity in technique lead us to recommend its trial.

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1001 MEDICAL ARTS BUILDING

### Discussion

DR. W. NORMAN THORNTON, JR., Charlottesville, Va.—The most satisfactory time to correct relaxation of the supporting pelvic structures is at the time of the initial pelvic operation. Secondary or subsequent procedures to correct relaxed pelvic supporting structures are frequently difficult and the results obtained may be disappointing. For these reasons, the careful examination and evaluation of patients prior to abdominal or vaginal operative procedures cannot be too strongly stressed.

The fundamentals of surgical repair of any hernia are to reduce it and maintain its reduction by supporting structures, rather than the utilization of some structure designed to suspend the herniation. These principles are observed in vaginal repair of prolapse of the vault, cervical stump, or uterus. It is for these reasons that the approach in general is vaginal.

However, in spite of careful preoperative examination and meticulous surgery, there will be a certain number of failures. The procedure designed and described by Drs. Williams and Richardson is worthy of consideration in those selected patients in whom vaginal repair has failed, or is not technically feasible. They have improved upon the method described by MacLeod (*J. Obst. & Gynaec. Brit. Emp.* **58:** 583, 1951) by leaving a portion of the muscle attached to the fascia. This innovation would seem physiological and desirable.

DR. ROBERT A. ROSS, Durham, N. C.—The impact of the word "new" sometimes creates a mild doubt; but the essayists have, by a deft maneuver, given us an added means of helping to correct a condition that, fortunately, is decreasing. They are not advocating a major procedure for a minor complaint; their patients had real and pressing problems. They wisely point out that when we find a multiplicity of procedures we might surmise that all are good or none is good. Their operation would seem to offer less chance of peritoneal trauma and possible resulting intestinal obstruction. We have not employed their operation, but are delighted to have recourse to their experience.

The follow-up of over 600 patients on whom the operation of vaginal hysterectomy was performed and a larger number who had abdominal total hysterectomy at Duke University Hospital revealed only 3 proved instances of vaginal vault prolapse. In referred patients who have the cervix remaining we remove the cervix and utilize the cardinal and uterosacral ligaments by the vaginal, or more rarely, the abdominal approach. When the cervix has been removed we have been able to recreate the uterosacral ligaments, or their peritoneal folds, and by anchoring these structures well forward and anteriorly we get support and little shortening of the vagina. We have employed the Moscheowitz operation on occasions in the past where enterocele was present and in three patients we fixed the vaginal vault to the abdominal wall, with no later ill effects.

In elderly widows the problem is much simpler. Colpectomy or colpocleisis is preferred. We would think that the use of the nonabsorbable aponeurosis acts similarly to the Alridge and other types of operation for urinary incontinence, though the included muscle portion may have some value. In any event, it is gratifying to find the authors interested in correcting all the pelvic abnormalities present in their patients, restoring women to normal physiologic and anatomic life, and the good results in their series speak for themselves. They also feel that the prophylaxis of prolapse is more important than means of cure.

DR. C. S. GLISSON, JR., Atlanta, Ga.—Dr. Ross, in his discussion, remarked he had not used the technique but gave lucid comments.

I was fortunate enough to employ it twice and have another case scheduled. The first operation was for prolapse of a cervical stump after laparotomy while the second followed a vaginal hysterectomy. The next one involves prolapse of the cervical stump following laparotomy and vaginal repair.

I would like to comment on only two facets: ease of operation and results. After discussing the first case with Dr. Williams without seeing a drawing, the operation was performed quickly and without difficulty. The same thing was true of the second.

These patients have been followed 12 and 7 months, respectively, with good results. The first patient reports good results in marital relations but I cannot speak for the second, since she is a widow.

## PROBLEMS OF DELIVERY OF THE OVERSIZED INFANT\*

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TWO previous studies<sup>1, 2</sup> of dystocia as related to difficult forceps delivery and the test of labor, respectively, seemed to indicate that the factor of importance was the size of the fetus as measured by weight. Obstetricians almost daily see women who are delivered of large babies with considerable ease; nevertheless, it was considered that a study of a large group of consecutive deliveries of large babies might shed some valuable clues as to the management of dystocia. In addition, the management of other obstetric problems associated with the delivery of large infants was studied.

### Material

This report concerns two groups of mothers: (1) all who were delivered of babies weighing 4,000 Gm. or more (8 pounds, 13 ounces) at the Mayo Clinic in the years 1933 through 1942; there were 575 such deliveries, and (2) an additional group of 98 who were delivered of babies weighing 4,500 grams or more at the Mayo Clinic in the years 1943 through 1950. During these latter years there were 836 deliveries involving babies weighing from 4,000 to 4,500 grams which were not included in our study. In addition, follow-up studies were made on 416 infants.

Our previous studies have indicated that while many deliveries are uneventful, disproportion does occur with a normal pelvis. Others<sup>3-8</sup> have studied the obstetrical problem of large babies and observed that difficulty in delivering the shoulders, and excessive lacerations of the vaginal wall and anal sphincter are more likely to occur than when babies are smaller. Others also have presented evidence that when fetuses are large, pregnancy extends longer than normally and male infants predominate.

### Results

*Period of Gestation.*—Findings in the series studied are in keeping with these observations in that the *average* period of gestation for 514 women in the 1933 to 1942 group was 40.7 weeks. In the 98 deliveries of babies weighing 4,500 grams or more, from 1943 to 1950, the average period of gestation was 40.9 weeks.

*Incidence of Males.*—There were more male babies than female babies in our series. Male babies made up 62 per cent of the group in which the weight at birth ranged from 4,000 to 4,249 grams, 69.2 per cent of those ranging from 4,250 to 4,499 grams, 77 per cent of those ranging from 4,500 to 4,749 grams, 73 per cent of those ranging from 4,750 to 4,999 grams. Larger babies who weighed more than 5,000 grams, while the number was small, tended to be more evenly distributed as to sex, about 65 per cent being male. I do not

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know any reason for this high predominance for male infants nor have I seen any offered in the literature. Possibly an endocrine factor could be involved in addition to over-all sex differences in weight.

*Labor.*—Of the primiparous women bearing infants weighing 4,000 to 4,499 grams, 54 per cent had entirely uneventful labors and 61 per cent had spontaneous or easy outlet forceps deliveries. However, 25 per cent required low forceps and 4.4 per cent required midforceps delivery and the incidence of difficult forceps delivery was 12 per cent. In the entire study about 1 in 4 of these forceps deliveries was difficult (grade 3 or 4 on the basis of 1 to 4). The incidences of cesarean section and of breech deliveries were both 3.7 per cent.

In this group were 360 multiparous women. Delivery was entirely uneventful for 78 per cent of these and was accomplished by outlet forceps or spontaneously for 90 per cent. The incidence of difficult forceps delivery fell to 3.4 per cent and the cesarean section rate was 1.7 per cent.

Shoulder dystocia occurred in labors of about 3 per cent of the primiparous women and in about 1 per cent of the multiparous patients. The incidence of excessive lacerations and damage to sphincters was almost identical with that of shoulder dystocia. When cesarean section proved necessary for the primiparous patients, its indication had been established in 4 out of 5 on whom it was undertaken by a test of labor which failed.

In the two groups there were 177 deliveries of babies who weighed 4,500 grams or more. Delivery was spontaneous or outlet forceps only were used in 78 per cent and no untoward obstetric difficulties were present in 62 per cent of these deliveries. Cesarean section was performed in 3.4 per cent, and 8.4 per cent were difficult forceps deliveries. Postpartum hemorrhage (5,000 c.c. or more blood lost) occurred in 16 of these cases and in 10, transfusion was required. The incidence of hemorrhage thus was 9 per cent. This compares favorably with the incidence of 10 per cent given by Eastman<sup>9</sup> for obstetric cases in general and was less than was anticipated at the outset of the study. It is, however, more than twice the incidence of postpartum hemorrhage occurring on the obstetric service at the clinic.

Among the 36 primiparous women who had babies weighing 4,500 grams or more, 6 required cesarean sections for delivery, an incidence of 16.7 per cent. All 6 had a test of labor lasting an average of 30 hours or more and complete or nearly complete cervical dilatation was obtained.

*Pelvimetry.*—It was interesting to note that pelvimetry was performed on 4 of these 6 primiparous patients who required cesarean section and the reports on 3 stated that the pelvis was adequate for normal delivery but obviously it could not accommodate the excessive weight and size of the fetus. Roentgen-ray pelvimetry was employed in only 22 cases of the whole series probably because usually the pelvis seemed ample on office measurement and in only two instances was any contraction of any degree reported and yet dystocia did occur in about half of this group. In this small but important segment of obstetric practice pelvimetry cannot be expected to be of great help due to the inordinate size of the babies. When it does reveal borderline contraction or real pelvic contraction, dystocia is likely.

*Height and Weight of Mothers.*—The height and weight of 183 women were recorded. The average height of these patients was 64.1 inches (162.8 cm.) and the average weight was 145.2 pounds (65.9 kilograms). This merely shows the rather obvious factor that larger women had larger babies but when the stature was smaller than the average dystocia seemed to be more of a threat.

*Mortality.*—No maternal deaths followed the 673 deliveries and the maternal morbidity was acceptably low. Among the 177 women who bore in-

fants weighing 4,500 grams or more only 7 had fever sufficient to be classified as morbidity, and 2 who were afebrile had thrombophlebitis. The morbidity rate was thus 6.4 per cent. Stillbirths and neonatal deaths together are represented by 15 deaths, a gross fetal mortality rate of 2.2 per cent. This, together with fetal morbidity, will be discussed later. My colleagues and I believe that this confirms the wisdom of the method of delivery of these patients although cesarean section was performed in only a small number of cases. The causes of fetal mortality are given in Table I.

TABLE I. CAUSES OF FETAL MORTALITY

CAUSE	CASES
Hydrocephalus	3
Anencephalus	1
Prolapsed cord	2
Breech delivery with aspiration and atelectasis	1
Abruption placenta	1
Fetal death in labor complicated by severe pre-eclampsia	1
Fetal deaths on admission	
Breech delivery elsewhere failed	1
Eclampsia, prenatal care elsewhere	1
Severe maternal diabetes	1
Atelectasis	1
Placenta previa	1
Mongolism and congenital urinary malformation	1
Total	15

*Infant Follow-up.*—The infant follow-up has been of particular interest to see whether or not the rate of cesarean section was too low and whether this low rate made for too many difficult forceps deliveries. The gross fetal mortality rate of 2.2 per cent (corrected by excluding fetal anomaly and fetal death before admission to 1.2 per cent) seems to justify the method of delivery. However, since prematurity is excluded in this series and since prematurity contributes so heavily to fetal mortality this gross figure of 2.2 per cent is not too low. I was curious to ascertain whether or not late adverse fetal effects would be unearthed from a prolonged follow-up of these children. The records of 489 deliveries occurring from 1933 through 1942 were satisfactory. One hundred fifty-seven babies could be followed only during their neonatal course in the hospital but the remaining 332 were followed for 1 month to 18 years with an average of 8.2 years. Three of these children died from lymphoblastoma, streptococcal cerebral meningitis, and tuberculous meningitis, respectively, several months or years following their delivery. Eighty-four of 98 babies delivered in the years of 1944 through 1950 weighing 4,500 grams or more have been followed.

Among the total of 416 babies there were these miscellaneous follow-up findings: 2 babies had convergent and 1 had alternating strabismus, all 3 babies had been born by easy spontaneous delivery; 2 infants suffered from encephalitis and meningocephalitis contracted from intercurrent infection after the age of 1 year (measles and influenza); 2 children had migraine which developed at 9 and 11 years but both of these children had had easy normal deliveries; 1 child (delivered spontaneously of a multiparous mother after a short labor) was mentally retarded (I.Q. 75) and had a speech defect at the age of 7 years. A depression of the right frontal area was observed during the neonatal period in 1 infant following a normal delivery but no neurologic manifestations were

noted. One child at 1 year of age had a generalized convulsion while undergoing a febrile episode but has been normal for 10 years thereafter. There were two adjustment or behavior problems in late infancy but the delivery of 1 of these infants had been easy. Delivery of the other had been a moderately difficult forceps delivery. The parents of this child were separated and the father was on parole from jail. One child had attacks of fainting diagnosed as being due to acidosis rather than epilepsy. The child had been delivered after a second stage of labor of 33 minutes by a low forceps operation that was not difficult. Two children of multiparous women who had been delivered spontaneously evidenced reading difficulties at ages 8 and 9 years. Two instances of neonatal dehydration fevers for 2 days were recorded. One child of a multiparous mother, delivered spontaneously after a second stage of labor of 15 minutes, began to have attacks of grand mal at the age of 3 years. This child was followed for 1 year during which phenobarbital therapy was employed and no further attacks occurred.

Two instances of birth injury did occur. One, a hemorrhage in the sternocleidomastoid muscle, followed a difficult breech delivery. When last observed the mass had entirely resolved and no disability remained. The other infant sustained an injury to the eye from a difficult forceps operation and while the vision was satisfactory the child still required eye exercises at the age of 14 years although his progress was thought to be satisfactory by the ophthalmologists.

This rather tedious recital of infants' illnesses and disabilities is given as it represents all of such occurrences found in all the years of follow-up on 416 infants in this study. It tends to confirm the impression that the 43 occasions of rather difficult forceps operations were justified since only one partial eye disability resulted and no immediate or remote neurologic deleterious effects have been unearthed. It is also gratifying to note no instances of Erb's palsy or any such results from the 16 breech deliveries and 28 occasions when there was some degree of shoulder dystocia in the delivery of these large babies.

*Shoulder Dystocia.*—A further comment with regard to the shoulders is in order. The incidence of this complication was only slightly higher than the incidence of breech deliveries in the whole series but it is pertinent to point out that difficulty with the shoulders occurred in 21 of the 177 deliveries of babies weighing 4,500 grams or more, a percentage of 11.8. The procedure which my colleagues and I have used for difficult delivery of the shoulders has been moderate Kristeller pressure on the fundus at the height of the pain and never more than general traction on the head to engage the anterior shoulder. If this procedure fails, we have resorted to Woods's<sup>10</sup> maneuver or DeLee's tight ring maneuver which are essentially the same. Both depend on spiraling the anterior shoulder down into the hollow of the sacrum or rotating the posterior shoulder up anteriorly. On rare occasions, we have taken women out of the stirrups and flexed the thighs on the abdomen in an extreme lithotomy position with beneficial effects in engaging large shoulders.

#### Conclusions and Comment

From this study the following conclusions seem warranted. Women who give birth to babies of excessive size are likely to be of somewhat larger stature than average and to carry pregnancy beyond their expected date of confinement. Male infants predominate among large babies and up to 77 per cent of the large babies may be males. The percentage of male infants increases with the size of the infants delivered until a birth weight of 5,000 grams is reached.

Although previous studies have shown the importance of fetal size in dystocia, it does not follow that women bearing large babies frequently have great difficulty with delivery. Deliveries for about two-thirds of all such patients are either spontaneous or by elective or easy outlet forceps delivery, and the outcome is uneventful.

The incidence of cesarean section is of much interest in this group. The over-all incidence was only 2.5 per cent but it was indicated almost solely by dystocia. All but 2 of the 17 cesarean sections were done because of dystocia; of the other 2, one was employed for a diabetic patient and even here fetal size was a consideration in the dystocia. The incidence of cesarean section varied from less than 2 per cent for the multiparous women up to 3.7 per cent for primiparous women bearing children between the weights of 4,000 and 4,499 grams. The incidence of cesarean section among 36 primiparous women bearing babies of 4,500 grams or more was 6 or 16.7 per cent. This high incidence of cesarean section in this select group seems well justified. All 6 patients had tests of labor lasting on an average of 30 hours and nearly complete or complete cervical dilatation was attained. The *average* weight of the 6 infants at birth was 5,360 grams. Stubborn persistence at vaginal delivery might have destroyed or maimed all of these large infants. While only less than 1 per cent of this whole series, they nearly equal in number the 8 infants lost (excluding fetal death on admission and monstrosity) in the entire series from *all* obstetric courses.

This small group of cases also indicates that when excessive fetal size is definitely suspected and when progress in descent of the fetal head does not match progress in cervical dilatation, the test of labor should not be too prolonged.

Multiparous women usually are delivered rather readily without cesarean section. An incidence of less than 2 per cent seems justified and only occasional forceps delivery or difficulty with shoulder dystocia is encountered.

A large episiotomy is indicated to avoid vaginal laceration, episiotomy extension, and sphincter damage although with proper repair even these untoward occurrences are not serious.

Unfortunately, pelvimetry either by office mensuration or roentgen ray is of little help since the excessive fetal size causes the disproportion with a normal pelvis. The obstetrician then must constantly be mindful of detecting an oversized infant and when dystocia is present and an oversized infant is suspected, cesarean section is indicated. As stated when there is a prolonged lack of engagement of the head under such circumstances, a test of labor should not be carried too far before cesarean section is performed.

There was no maternal mortality in the 673 cases and maternal morbidity was not excessive. The uncorrected fetal mortality rate was 2.2 per cent. Correction for fetal death on admission and for congenital anomalies incompatible with life revealed 8 infant deaths among 673 deliveries or a mortality rate of 1.2 per cent. The remote adverse effects of delivery have proved to be nil for 332 children followed for an average of 8.2 years in one group and for another more recent group of 84 followed for a shorter time.

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## A NEW SYNDROME IN LABOR: FRANK BREECH PRESENTATION, PERSISTENT SACROANTERIOR POSITION, ASSOCIATED WITH DYSTOCIA\*

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THE following cases of dystocia with a certain type of breech presentation are detailed as to the facts noted at the time of delivery.

CASE 1.—1943. Mrs. E. S., a white primigravida with median constitutional type, aged 38 years, went into labor at term with her general condition normal, including hemoglobin of 11 Gm. X-ray of the pelvic inlet revealed the anteroposterior obstetric diameter to be 11 cm. and the transverse 13 cm., with a wide midpelvis. The lateral soft-tissue film (Fig. 1), on the day of delivery, showed a normal-sized fetus with frank breech, sacrum directly anterior. Her labor contractions began at 3 A.M. one morning two days prior to the estimated due date, with false labor contractions, and continued thus irregularly until 4 A.M. the next day, a period of twenty-five hours. At this time they became painful enough to warrant administration of sedation, 4½ grains of pentobarbital and 1/100 grain hyoscine, given per rectum. From then on the contractions were up to three minutes apart and lasted forty-five seconds with very firm contraction of the uterus. Three grains more of pentobarbital were given two hours later. Following this the uterus contracted so firmly and so frequently that morphine, 1/8 grain, hyoscine, 1/200 grain, were given intravenously. This allowed some rest, but had no effect upon engaging the presenting part and did not dilate the cervix, which was then no more than 2 cm. dilated, with the presenting part high. Contractions continued at regular intervals of 5 to 6 minutes, of such intensity that it was feared that the uterus would rupture. The fetal heart rate was altered considerably. At 2 P.M., 25 hours after onset of false labor, and 10 hours after onset of true labor, she was delivered by cervical cesarean section. There were found considerable edema and ecchymosis of the lower uterine segment. The amniotic fluid was of the color and consistency of pea soup. The fetus was exposed with the sacrum directly anterior with frank breech not engaged. The fetal back was rolled over and the left leg delivered first, followed by the body and head. The infant was deeply depressed, in asphyxia pallida, with the heart beating very slowly and feebly. There was a hematoma of the umbilical cord 4 cm. long and 1 cm. in diameter. The placenta was bilobate with the main lobe high on the posterior wall and the small lobe on the anterior wall over the apex of the uterus. The infant, a boy, weight 8 pounds, 2 ounces, was given tracheal insufflation for 30 minutes and revived. He went home with the mother on the twelfth day. He has been observed from time to time for the past eight years and apparently was not damaged, since he is now of above average development and intelligence.

CASE 2.—1946. Mrs. D. K., a white woman, aged 19 years, an apparently normal primigravida at term, had a hemoglobin of 10 Gm. and was admitted to the hospital for induction of labor because of a large fetus. X-rays on that day revealed an anteroposterior obstetric diameter of the inlet 11.5 cm. and transverse diameter of 12.25 cm. The lateral soft-tissue film (Fig. 2) showed the presentation to be breech, with the sacrum directly anterior. Induction of labor was done by catheter insertion and vaginal pack, which were removed the next day. Her experienced obstetrician, who seldom resorted to cesarean section,

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stated that she remained in labor two days, and then began to have bright red vaginal bleeding. At that time a low cervical cesarean section was performed, and a healthy female infant weighing 9 pounds, 5 ounces was delivered from breech presentation. The placenta showed evidence of partial previous separation.



Fig. 1.—Skiagraph of lateral soft-tissue x-ray films depicting the fetus in frank breech presentation with sacrum anterior. In each film the arms were identified but deleted from the tracing.

CASE 3.—1943. A. M., a Negro primigravida of median constitutional type, at term, with hemoglobin of 9 Gm., had not attended the prenatal clinic for three months. She went into false labor at home, and the first 24 hours may be described best in the style of the medical student: "On Friday night (Nov. 26, 1943) at approximately 8 P.M. I was called to this patient, a Negro primipara, approximately 21 to 22 years old, on Outside Obstetrics. On my arrival there she complained of labor pains approximately 5 minutes apart. I cannot vouch for the severity of the pains, but the patient described them as 'If they git much worse, I can't stand them.' Patient said she knew she was at least 9 months pregnant, but didn't remember exactly when she ceased menstruating. Physical examination showed that this patient had the most remarkably hard uterus I had ever tried to palpate. In an attempt to ascertain the position of the fetus, I thought it a breech, but was not sure because of this hardness. There was no bleeding or discharge from the vagina. On rectal ex-

amination, I could not palpate the head of the fetus. I remained with the patient for approximately two hours. During this time the pains remained of the same frequency and she described them as hard. At the end of the two hours, I still could not palpate the head and called the resident for advice as to what to do. He suggested I give the patient Nembutal for sleep and come on back. I did this, but cautioned the family to call me if labor seemed to progress



Fig. 2.—Skiagraph of lateral soft-tissue x-ray films depicting the fetus in frank breech presentation with sacrum anterior. In each film the arms were identified but deleted from the tracing.

any. I was not called Friday night or the next morning, but went out about noon, Saturday, November 27, to see her. She described the interval between the visits as one without sleep Friday night and frequent pains throughout the night and of less frequency Saturday morning. A diagnosis of breech presentation was made. I was called to the home of the patient about 6 P.M. with the complaint of frequent (approximately 5 minutes) labor pains.

She was brought to the hospital and admitted at approximately 8 P.M., Saturday, Nov. 27, 1943." The resident who examined her in the hospital recorded that she was lying quietly in bed having seemingly light labor pains every 5 to 6 minutes. He diagnosed breech presentation and ordered x-ray studies. Her hemoglobin at that time was 9 Gm., fetal heart tones were recorded as 140 per minute, 4 cm. to right of the umbilicus. On Sunday, November 28, my notes are recorded as follows: "Pain began at 6 A.M. Friday, slow Friday, all Friday night, all day Saturday, and today. No sleep, she states. Contractions every 5 minutes since last night. X-ray shows frank breech presentation with the sacrum directly anterior. The inlet anteroposterior diameter is 10.5 cm., transverse 11.5 cm., with inflaring midpelvis. This lateral view shows the suboccipital bregmatic diameter of the fetal head to be 9 cm. This presentation is identical to that of Mrs. E. S. of October last. The patient is still in good condition as to hydration. There is a meconium-stained discharge. The membranes ruptured Friday. I believe we will have to do a cesarean section if we wish a live baby." However, as she had at that time a temperature of 102° F., pulse 100, with membranes long ruptured and a relatively slightly contracted pelvis, she was given a rest and further hydration, without any effect on dilating the cervix or engaging the presenting part, but the temperature returned to normal. Laparotrachelotomy was performed early Monday morning, with delivery from frank breech, sacrum directly anterior, of a female infant, who weighed 9 pounds, 1 ounce, and required insufflation. The mother recovered without complication, but the infant died in a few days. Autopsy revealed "brain hemorrhage, petechial only; air in pleural cavity none; air in stomach none; lungs well expanded; tracheal injury none."

CASE 4.—1940. Mrs. D. S., a poorly developed and poorly nourished white primigravida, aged 15 years, entered the hospital at the end of the eighth month for nausea and vomiting and rather severe pyelitis. On sulfanilamide, the fever came down and she was doing well when, on the third hospital day, the membranes were reported to have ruptured spontaneously. For the next six days, in spite of small doses of Pitocin over a period of 24 hours, of calcium gluconate a day later, and morphine still a day later, she remained in false labor which appeared at times to approach normal labor. The presenting part did not become well engaged. Evaluation on the sixth day revealed the presenting part to be high, with the cervix thick and dilated to the size of a 25 cent piece. The urine continued to contain large amounts of leukocytes. The hemoglobin was 10 Gm. The fetal heart tones were best heard near the umbilicus. X-rays taken during this time revealed the anteroposterior diameter of the pelvic inlet to be 10 cm. Lateral film showed a near-term fetus in frank breech presentation, the sacrum directly anterior. Cesarean section was considered but, due to the infection and prematurity of the fetus, it was decided to administer transfusions, to introduce a large bag into the uterine cavity, and, when the cervix was dilated, to deliver the fetus by extraction. The large Voorhees bag was expelled in three hours and the infant artificially delivered from frank breech presentation. From the record, it is possible that the membranes were not previously ruptured, or, if they were, only by a small hole which became semiclosed. Prior to delivery the fetal heart rate was recorded in the nurse's records to be as high as 188; but this was reduced by oxygen, administered to the mother. At delivery the infant, a male, weight 5 pounds, 12½ ounces, had no cyanosis and required no insufflation. He progressed normally and went home on the twenty-fourth day. The day after delivery the mother's temperature rose to 105.6° F., pulse 120, but returned to normal after the fifth day. She was about ready to be dismissed when, on the eighth day post partum, she was found dead in bed by the early morning nurse. No autopsy was permitted. It was presumed that she died of a pulmonary embolus.

In addition to these four cases there were found 13 more lateral soft-tissue films in which the presentation was frank breech with the sacrum approximately anterior, as illustrated. These were obtained from a collection of more than 3,000 lateral soft-tissue films taken at or near term, 200 of which were records of breech presentation of various types. These represent a thousand labors per year for ten years, among which no other cesarean section was done because of breech presentation, and in which I recollect not more than one other in which

the presentation was breech. The total cesarean section rate in all of the labors was less than 0.5 per cent. We made use of attempts at external version late in pregnancy and this may influence the incidence of breech labors. As noted from a study of Table I, all of the others delivered living infants spontaneously, with the exception of No. 9, in which case we were unable to locate any record of the labor. In nine of the thirteen, the sacrum rotated to the left in six (Cases 6, 7, 8, 12, 13, 14) and to the right in three instances (Cases 10, 16, 17). In two patients (Cases 5, 15), external version was done. In one other, spontaneous version occurred (No. 11), and all three delivered from cephalic presentation without complications. All of the dystocia cases occurred in the first labor. For the most part, the other patients were multiparas.

The term pregnant human uterus is a muscular bag, roughly 30 cm. long, 24 cm. wide, and 20 cm. anteroposteriorly, with walls 0.5 cm. or so thick. Observing an autopsy on a term pregnant human body, one notes that there may be a longitudinal sulcus along the center of the posterior aspect of the uterus due to the inward protrusion of the maternal vertebral column. It is possible in this type of breech presentation that one of the heels of the fetus lies on one side of the maternal spinal column and the other heel on the opposite side. In primigravidae, especially, the abdominal wall structures are apparently rather tight and may hold the fetus more or less fixed to this position, even before labor or between contractions. During contractions the effect is accentuated by a presumed anterior bowing of the fetal spine which creates a large, rounded presenting part which does not engage well. This, then, apparently produces a labor mechanism similar to that of a large cephalic presenting hydrocephalus or transverse presentation with fetal back downward, which covers the pelvic inlet without the usual dilating effect upon the cervix. The uterus, having no good outlet for its contents, tends to contract in abnormal types of labor or dystocia dystrophia type with continuing damage to the fetus from anoxia and great danger of ultimate uterine rupture. All of these various contractions were present in the three cases personally observed, although, at the time, the true significance was not noted.

Management depends upon early recognition and this may best be accomplished by simple x-ray flat film of the uterus and its contents at the time of early dystocia in breech presentation. This film should show the exact state of affairs, the heels in front of the face, one on one side and one on the opposite side of the maternal spinal column. The lateral soft-tissue film, which is more or less routine in our clinic, shows the condition not quite so adequately, because one is not sure whether the fetal heels lie on opposite sides of the mother's spine. In assaying the lateral film, the images of the two fetal femurs should lie fairly close together. One readily notes that some of these additional cases might not have fallen in this category had a flat film also been available.

External version may be successful, especially if the patient is placed upon a Bradford frame, with the abdomen protruding downward through a large hole in the covering. In this manner the uterus may fall away from the vertebral column and the fetus be more easily turned, at least to a left or right position. If this is unsuccessful and the pelvic canal is adequate for the fetal head, the proper procedure would be early insertion of a large bag through the cervix without rupturing the membranes. When the cervix is fully dilated, the fetus may be quite safely extracted. Oxygen to the mother, blood transfusions, if she is anemic, and proper sedation give added protection to both patients. Episiotomy reduces the danger to the fetus. In some cases cesarean section may be the method of choice, especially if, as in some of ours, the condition proceeds beyond more conservative methods.

Evidence has been presented in regard to the hypothesis that labor dystocia may be associated with a certain type of frank breech presentation, to wit, sacrum

TABLE I. ESSENTIAL DATA IN REGARD TO LABOR IN 17 PATIENTS WITH LATERAL SOFT-TISSUE  
IN PREGNANCY

CASE	YEAR	PATIENT	RACE	AGE (YEAR)	PARITY	TYPE	HEMO-GLOBIN	COMPLICATIONS
1	1943	E. S.	W	38	Primipara	Median constitutional type	11 Gm.	
2	1946	D. M. K.	W	19	Primipara		10 Gm.	
3	1943	A. M.	N	25	Primipara	Well developed, well nourished	9 Gm.	
4	1940	D. S.	W	15	Primipara	Median constitutional type	10 Gm.	Pyelitis and vomiting 12-2-40
5	1940	E. B.	W	28	G. vi, P. iii			Normal blood, etc.
6	1941	L. M.	W	25	G. iii, P. ii	Median constitutional type	12 Gm.	
7	1944	E. B.	N	17	Primipara	Median constitutional type		
8	1946	F. M.	N	18	Primipara	Obese	13.5 Gm.	Pre-eclampsia
9	1946	L. R.	N					
10	1947	O. M. W.	N	22	G. ii, P. i		11.5 Gm.	Syphilis, Wassermann 4 plus
11	1947	I. B.	N	41	G. vii, P. vi			
12	1948	B. D.	N	22	Primipara	Slender		
13	1948	E. M. W.	N	39	G. xii, P. x	Obese		Mild pre-eclampsia 140/90
14	1949	E. W.	N	21	G. ii, P. i	Median constitutional type		
15	1949	D. G.	N	38	G. xii, P. x	Obese		Diabetes mellitus since onset of this pregnancy
16	1949	E. A.	N	28	G. vii, P. vi	Obese		
17	1950	T. L.	W	29	Primipara			

## ROENTGENOGRAMS INDICATING FRANK BREECH PRESENTATION, SACRUM ANTERIOR, LATE OR IN LABOR

LABOR	X-RAY	FETUS
Frank O. A. at cesarean. No engagement at any time. Labor 35 hours, then low section	X-ray, A. P. 11 cm., T. 13 cm.	⊖→ 8 pounds, 2 ounces. Depressed, slow F. H. T. Insufflation 30 minutes
Cesarean section, low cervical	X-ray, A. P. 11.5 cm., T. 12.25 em. same day	⊕+ 9 pounds, 5 ounces. Breathed spontaneously
Labor apparently normal with severe contractions of 5 minutes without engagement or dilation of cervix beyond 3 cm.	X-ray same day, A. P. 10.5 cm., T. 11.5 cm., somewhat narrow midpelvis. Lat. and head S. O. B. 9 cm. S. A.	⊕+ 9 pounds, 1 ounce. Fair condition at delivery, but died. Autopsy
Membranes ruptured 12-5-40; Divided doses Pitocin 12-6-40; Calcium gluconate 12-7-40; Morphine 12-9-40, 12-10-40, 12-11-40. Cervix dilated 3 cm., presenting part high. Voorhees bag 12-12-40. Extraction frank breech 3 hrs. later.	X-ray during labor, A. P. 10 em., T. 12 cm.	⊖→ 5 pounds, 12 1/4 ounces. Lived. No insufflation necessary
Normal cephalic labor. No laceration	X-ray, lateral, 6 days before admission. Then external version done.	
Frank breech, L. S. A., labor 3 hours, 50 minutes	X-ray in labor, A. P. 11 cm., T. 14 cm.	⊕+ 5 pounds, 12 ounces
Frank breech, spontaneous, labor 13 hours, L. S. A.	P. M. taken. Pelvis ample	⊕+ 7 pounds, 9 ounces. B. P. 10 cm., S. O. B. 10 cm.
Frank breech. Delivery spontaneous. Labor 7 hours, 25 minutes, L. S. A.	A. P. 12 cm., T. 11.8 cm.	⊕+ 7 pounds, 12 ounces. S. O. B. 9 cm., B. P. 9.5 cm.
Labor 3 hours, R. S. A.		⊕+ 6 pounds, 4 ounces. S. O. B. 9.5 cm., B. P. 9.5 cm.
Labor, spontaneous delivery. L. O. T. 2 weeks after x-ray. Labor 8 hours, 25 minutes. Maternity shelter	Pelvis A. P. 9 cm., T. 12 cm., Spontaneous version	⊕+ Living
3 hours spontaneous delivery. Labor S. L. A., frank breech	X-ray same day, A. P. 11 cm., T. 13 cm.	⊕+ 6 pounds, 8 ounces. S. O. B. 9 cm., B. P. 9.5 cm.
Labor 20 hours, 48 minutes. L. S. A.	X-ray same day as delivery	⊖→ 9 pounds, 4 ounces. B. P. 10 cm., S. O. B. 9.5 cm.
Labor maternity shelter. Labor 11 hours, 35 minutes. S. L. T. frank breech	X-ray 9 days before delivery	⊕+ 7 pounds, 3 ounces. B. P. 9.5 cm., S. O. B. 9.5 cm.
Labor 6 hours, 15 minutes. L. O. A.	X-ray 8/31/49, delivery 9/22/49, external version 9/1/49	⊖→ 8 pounds, 5 ounces
Spontaneous delivery. Labor 8 hours, 35 minutes. R. S. A.		⊕+ 6 pounds, 13 ounces. B. P. 9 cm., S. O. B. 9.25 cm.
Labor, spontaneous. Retained placenta. Manual removal at 50 minutes. R. S. A.	X-ray. A. P. 11.5 cm., T. 13.5 cm., ischial spines 11 cm.	⊕+ 7 pounds, 14 ounces. Insufflation 2 minutes

directly anterior, especially in a primigravida. The reasons for this association have been postulated. It would be of interest to ascertain evidence for or against this assumption by reviewing the x-ray films taken in association with breech deliveries by cesarean section in various clinics. Most likely, the x-rays in these cases would be "flat films" and probably they may be more conclusive.

A cursory review of papers on breech written in the English language has not revealed any mention of such a syndrome.

### Discussion

DR. ROWLAND F. ZEIGLER, Florence, S. C.—I reviewed our cesarean section cases for breech presentation that were previously x-rayed during labor at the McLeod Infirmary. All of our sections in breech presentations were done for definite disproportion or concomitant uterine hemorrhage. I regret that I cannot present additional x-ray evidence of this syndrome, for a hasty search through our breech films of the past 3 years failed to reveal this particular picture. Most of our films were of primigravidas, and all that showed sacrum approximating direct anterior on lateral films proved in the anteroposterior to be directed to either the left or right. This may mean little, however, since Dr. Torpin found only 17 cases or less meeting his suggested x-ray criteria, from 200 breech films over a ten-year period. Fortunately, therefore, the syndrome is not too common. Yet, hearing his case reports sounds a familiar note and makes me feel as though somewhere in the past I have "sweated out" just such a labor and situation, though I cannot specifically earmark it. I'm sure most of you feel the same.

Dr. Torpin cites 13 additional cases of frank breech presentation with a position of sacrum approximately anterior found in films which were taken at or near term. I assume most of these were made before the onset of labor. All 9 of these 13 that remained breech (that were not converted into cephalic presentations) rotated and delivered spontaneously. From this we note that better than 2/3 of the labors proceeded and terminated uneventfully. Multiparity, as suggested, might have been the important factor in these remaining cases. It seems, however, that the crux of the situation as to whether dystocia might be expected or not in these frank breech presentations is the *ultimate* position, or the position sometime after the onset of uterine contractions. Those that persist in the direct sacroanterior position are apparently the ones in which dystocia is to be anticipated. It might, therefore, be well to include the word *persistent* with the described position as being perhaps more fitting for the dystocia syndrome. Dr. Torpin points out that "early recognition is best accomplished by x-ray flat film at the time of early dystocia in breech presentation." The fetus at this time, after trial at labor, should be in the ultimate position.

Dr. Torpin deserves much credit for alerting this group to a possible new dystocia syndrome, which, if proved valid by additional evidence, should mean another step toward further lowering the infant mortality of breech presentations.

*Note by Dr. Torpin.*—The subsequent addition of the word *persistent* in the title is due to Dr. Ziegler's timely suggestions.

## EPIDERMOID CARCINOMA OF THE CERVIX COMPLICATING PREGNANCY\*

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DURING the past three years Hirst,<sup>1</sup> Sadugor and associates,<sup>2</sup> and Johnson and associates<sup>3</sup> have called our attention strikingly to their observations that carcinoma of the cervix occurs more frequently during pregnancy than most obstetricians believe. Our purpose in presenting this paper is to further confirm their contention with the hope of stimulating greater interest in this grave complication of pregnancy.

We are well aware of the difficulties encountered in differentiating intraepithelial carcinoma of the cervix from benign histopathological changes seen in the pregnant cervix as most recently described by Nesbitt and Hellman.<sup>4</sup> This presentation does not include intraepithelial carcinomas.

Cytological screening methods during pregnancy have not been available to us and the diagnosis in each instance was made upon biopsy of suspicious or obvious lesions. We have not hesitated to biopsy any pregnant cervix, nor have we seen any ill effects from this procedure. It is our firm conviction that some screening method must be employed if one hopes to discover the asymptomatic malignancies in the pregnant cervix. Many cervices during pregnancy appear abnormal on visualization and it is difficult to establish criteria for biopsy.

### Material

This study covers a five-year period from July 1, 1946, to July 1, 1951. During this time there were 8,450 deliveries in the University of Virginia Hospital and 5 epidermoid carcinomas of the pregnant cervix were discovered. The incidence rate is 0.059 per cent, or one carcinoma in every 1,690 deliveries. This incidence rate adds further support to the statements made by others that carcinoma of cervix in pregnancy is not as rare a complication as formerly believed. In addition, three cases not included in Part I of this paper were referred to us and are discussed in Part II.

TABLE I. INCIDENCE RATE OF CARCINOMA OF CERVIX IN PREGNANCY,  
JULY 1, 1946, TO JULY 1, 1951

Total deliveries	8,450
Carcinoma of pregnant cervix	5
Incidence rate	.059%

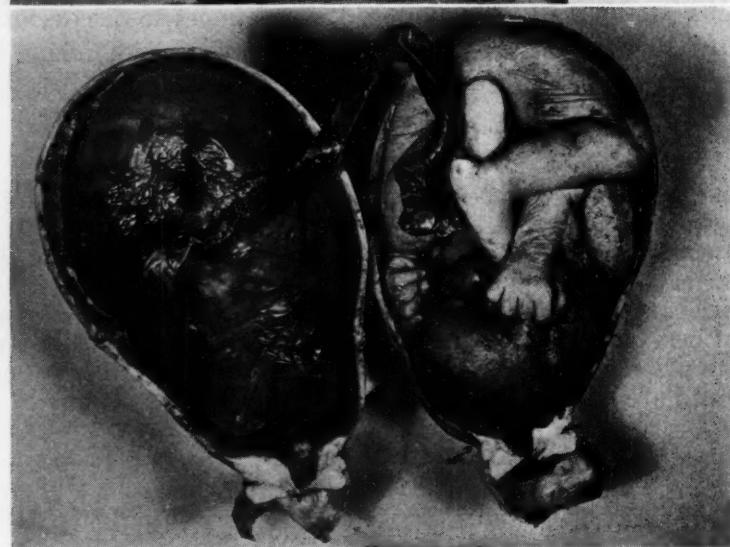
\*Presented at the Fourteenth Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Clearwater, Fla., Jan. 24 to 26, 1952.

### Part I Report of Cases

The 5 cases are briefly summarized in the following reports.

CASE 1.—E. B., a 36-year-old Negro woman, gravida v, was seen by us for the first time at term with intrauterine death of the fetus, ruptured membranes and intermittent labor pains of 4 days' duration. A Stage II carcinoma of the cervix was found and biopsy showed epidermoid carcinoma of the cervix, Grade II. The patient had no signs or symp-

A.



B.

Fig. 1 (Case 1).—A, Extensive involvement of cervix by a clinically asymptomatic tumor.  
B, Formalin-fixed specimen showing failure of cervix to dilate.

toms of cervical malignancy whatsoever during pregnancy and vaginal examination had not been done. Radical abdominal hysterectomy with bilateral pelvic lymph node dissection was done and a macerated fetus weighing 2,948 grams delivered. The pathological examination of the surgical specimen showed metastasis to lymph nodes. The patient's postoperative convalescence was afebrile on penicillin and streptomycin and she was ambulatory on the fourth postoperative day. She died suddenly on the seventh postoperative day from pulmonary embolism.

CASE 2.—R. M., a 35-year-old white primigravida, was followed prenatally by her family physician who had not done a pelvic examination. She was admitted to the University of Virginia Hospital at term in active labor. There had been no bleeding or other

Fig. 2.

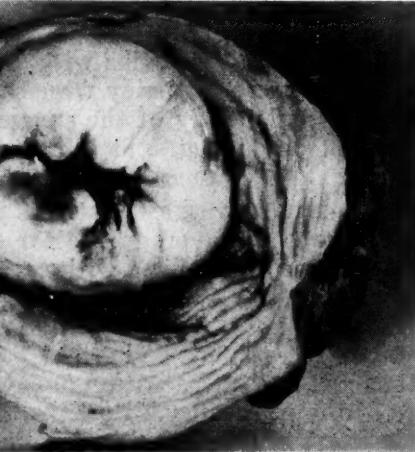
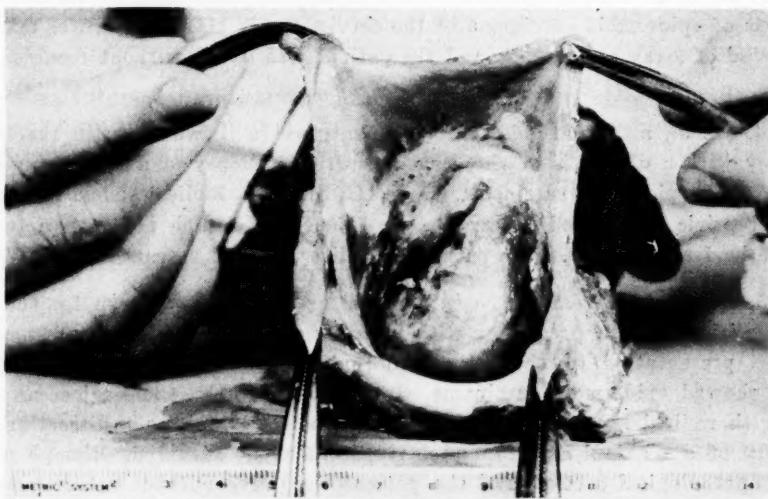


Fig. 3.

Fig. 2 (Case 2).—Extension of vaginal wall.

Fig. 3 (Case 4).—Surgical specimen. Squamous epithelium intact, except biopsy sites.

symptoms during pregnancy. An extremely hard cervix was biopsied and showed epidermoid carcinoma, Grade II. Clinically, the tumor was classified as Stage II. Radical abdominal hysterectomy with bilateral pelvic lymph node dissection was done. There was some question as to the viability of the fetus and for this reason classical section was done

prior to the radical surgery with delivery of a 3,402 gram stillborn infant. The pathologist demonstrated metastasis to multiple lymph nodes and deep x-ray therapy was given postoperatively. Nine months later the patient was seen with an infiltrating duct carcinoma of the right breast with axillary metastases. Radical mastectomy was done. Twenty-six months after treatment for the epidermoid carcinoma of the cervix the patient was living with pulmonary and choroid metastases. The pelvis remained free of demonstrable recurrence of tumor (Fig. 2).

CASE 3.—N. C., a 44-year-old white woman, gravida ix, was seen in the outpatient clinic 8 days prior to delivery and pelvic examination was not done. There had been no bleeding during pregnancy and notation was made that pelvic examination was not made as patient was at term. She spontaneously delivered a 3,600 gram viable child without complications of labor or the puerperium. She was seen 6 weeks postpartum at which time the diagnosis of epidermoid carcinoma of the cervix, Grade III, Stage I, was made. Treatment consisted of x-ray and radium and the patient was living without recurrence 3 years later.

CASE 4.—L. J., a 29-year-old Negro woman, gravida ii, was seen in the tenth week of pregnancy with a diagnosis of threatened abortion. Biopsy of a normal appearing but firm cervix showed epidermoid carcinoma, Grade III, Stage I. Radical abdominal hysterectomy and bilateral pelvic lymph node dissection were done, and lymph nodes were found microscopically to be free of tumor. The patient was alive and well 2 years later (Fig. 3).

CASE 5.—K. T., a 29-year-old Negro woman, gravida vii, was seen for the first time in the thirty-third week of pregnancy with bleeding of one day's duration associated with a transverse presentation of the fetus. Placenta previa was strongly suspected. Investigation showed epidermoid carcinoma, Grade III, Stage I. Classical cesarean section combined with radical hysterectomy and bilateral pelvic lymph node dissection was done with delivery of a viable 1,790 gram premature child who survived. Lymph nodes were negative on pathological section and the patient was alive without recurrence 8 months later.

Two additional multigravidae with an original diagnosis of early invasive carcinoma of cervix in pregnancy were seen during the same period of study. Extensive microscopic study of the surgical specimens reclassified the tumors as intraepithelial carcinoma, and these two patients are not included in this series.

The average age for the 5 patients is 34.6 years which is considerably lower than the reported average age for epidermoid carcinoma of the cervix. The average age for all patients with carcinoma of the cervix seen by us during this same period is 47.4 years. The cases presented illustrate that carcinoma of the pregnant cervix may be asymptomatic or simulate more common complications of pregnancy. The first 3 cases presented serve to emphasize the importance of careful palpation and visualization of the cervix regardless of the stage of the pregnancy. Perhaps Hirst<sup>1</sup> has the proper approach in advising pelvic examination twice during pregnancy. Certainly there is no contraindication to a carefully conducted pelvic examination during the last weeks of pregnancy in those patients who have not been seen previously. It is our policy to investigate the cervix of each patient seen for the first time by us, regardless of the stage of the pregnancy. The fact that 4 of the 5 patients received radical operation does not imply that we believe this form of therapy to be the method of choice in the treatment of epidermoid carcinoma of the cervix in pregnancy. However, we do feel that it has its place in selected cases.

## Part II

Our interest in epidermoid carcinoma of the cervix as a complication of pregnancy prompted us to investigate the records of all patients with carcinoma of the cervix seen in our clinic during the same five-year period. It was our purpose to determine, if possible, the time relationship between pregnancy and the development and diagnosis of carcinoma of the cervix. Two hundred eighty carcinomas of the cervix were seen during the five-year period. The various types of malignancy seen are shown in Table II.

TABLE II. TYPES OF MALIGNANCY

Epidermoid	271
Adenocarcinoma	8
Epidermoid and adenocarcinoma	1
Total	280

It is also interesting to note that 90.3 per cent of the patients had been pregnant at some time as shown in Table III. This may appear significant, but Morris and Meigs<sup>5</sup> have previously pointed out the fallacy of attaching significance to pregnancy as an etiological factor in carcinoma of the cervix.

TABLE III. GRAVIDITY

	NUMBER	PER CENT
Nulligravidas	19	6.8
Not stated	8	2.9
Gravidas	253	90.3
		100.0

Table IV shows those patients known to have been pregnant at the time of the diagnosis of carcinoma of the cervix, including both the 5 cases previously discussed and 3 cases referred to us who were known to have been pregnant at the time of the diagnosis of carcinoma of the cervix. The diagnosis was confirmed in each instance by rebiopsy. The eight cases comprise 2.9 per cent of all carcinomas of the cervix seen during the five-year period of study. The average age for the group is 34 years.

TABLE IV. PREGNANCY AND EPIDERMOID CARCINOMA

CASE	AGE	RACE	STAGE
University of Virginia Hospital cases			
1. E. B.	36	Negro	II
2. R. M.	35	White	II
3. N. C.	44	White	I
4. L. J.	29	Negro	I
5. K. T.	29	Negro	I
Cases referred to University of Virginia Hospital			
6. W. E.	25	White	IV
7. J. C.	34	White	I
8. D. B.	39	White	IV

The incidence of carcinoma of the cervix associated with pregnancy is greatly increased if we add to these 8 cases, 5 additional cases seen within 9 months after the termination of a pregnancy. Table V shows the age, stage, and interval between the termination of a pregnancy and the diagnosis of epidermoid carcinoma. The average age of the patients in this group is 35 years. There would not seem to be much doubt that these 5 patients had carcinoma

of the cervix associated with the pregnancy. If one accepts this statement, there were 13 epidermoid carcinomas of the cervix in the total of 280 malignant tumors of the cervix, an incidence rate of 4.64 per cent.

TABLE V. INTERVAL BETWEEN PREGNANCY AND DETECTION OF MALIGNANCY

CASE	AGE	RACE	STAGE	INTERVAL (IN MONTHS)
9. O. H.	28	White	III	3
10. E. B.	30	Negro	II	6
11. C. S.	35	White	I	7
12. H. G.	40	Negro	III	9
13. W. H.	46	White	IV	8

In addition to the 13 cases presented, there were 7 of the 280 carcinomas of the cervix diagnosed within 24 months after the termination of a pregnancy. Since carcinoma of the cervix may be of long duration prior to its diagnosis, Table VI is presented as a matter of interest and for speculation.

TABLE VI. INTERVAL BETWEEN PREGNANCY AND DETECTION OF MALIGNANCY

CASE	AGE	RACÉ	STAGE	INTERVAL (IN MONTHS)
14. C. G.	24	White	II	24
15. G. H.	26	Negro	I	16
16. G. W.	29	White	IV	14
17. A. C.	33	White	IV	24
18. R. C.	36	White	II	24
19. E. P.	38	White	III	24
20. W. W.	46	White	II-III	24

### Summary and Conclusions

1. A five-year study of epidermoid carcinoma of the cervix and its observed relationship to pregnancy is presented.
2. Five epidermoid carcinomas of the cervix complicating pregnancy in a series of 8,450 consecutive deliveries are presented.
3. The incidence rate of 0.059 per cent is higher than generally believed as pointed out in the studies of other authors.
4. Eight, or 2.9 per cent, of 280 carcinomas of the cervix seen during the period covered by the study were known to have occurred during pregnancy.
5. Thirteen, or 4.64 per cent, of the 280 carcinomas of the cervix were known to have occurred during pregnancy or within 9 months after the termination of a pregnancy.
6. The time relationship between pregnancy and diagnosis of carcinoma of the cervix as observed in our series is presented.
7. The importance of careful investigation of the cervix during pregnancy and the puerperium is stressed.
8. There is no contraindication to cervical biopsy during pregnancy, but it is believed that some type of cytological screening method should be employed during pregnancy to prevent the great delay in diagnosis of this grave complication of pregnancy.

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### Discussion

DR. H. B. LOTT, Tampa, Fla.—It is interesting that Dr. Thornton has chosen to devote his study to epidermoid carcinoma of the cervix of the invasive type, in view of the present-day tendency to focus attention on intraepithelial or noninvasive carcinoma. I believe it is timely that we are refreshed in what we know about invasive carcinoma complicated by pregnancy, in the light of its pressing need for immediate treatment.

His contention that the incidence of this carcinoma is higher than is generally believed is not disputed. That is readily understood and experience shows that the incidence of carcinoma of the cervix in either private or clinic patients, pregnant or not, will rise proportionally to the number of biopsies, and/or cytologic studies made of these cervices. Dr. Thornton evidently biopsies more pregnant cervices than do most of us.

I would like to ask Dr. Thornton how he determines which cervix he will biopsy. Of his 5 cases presented, 2 were at term, 1 at 33 weeks, 1 at 10 weeks, and 1 at 6 weeks post partum. None of these were seen prior to the examination at which the diagnostic biopsy was made. Most of us in private practice see patients first at 8 to 10 weeks, and only occasionally is a patient in the last trimester, more rarely at term, when first seen. Inspection of the cervix should be routine at any first visit, but how many of us feel that a mild erosion, such as is occasionally seen at 10 weeks, requires biopsy?

It might be speculated that the influence of pregnancy on an existing carcinoma might make a lesion which appears insignificant at 8 to 10 weeks much more impressive as term is approached. Thus a reinspection of a benign-appearing lesion seen early in pregnancy might be indicated 4 to 6 weeks from term. In my own practice I have not had the occasion to see a patient with carcinoma of the cervix and concomitant pregnancy. Perhaps more frequent biopsy or cytologic study is indicated.

At the Tumor Clinic of Tampa Municipal Hospital there were 162 cases of epidermoid carcinoma of the cervix from February, 1948, to January, 1952. Of these 162 patients with malignancies only 2 were pregnant at the time of diagnosis and treatment, an incidence of 1.2 per cent. This is somewhat lower than the 2.9 per cent found in 280 cervical carcinomas by Dr. Thornton. The first case was that of a 37-year-old woman, gravida x, para ix, referred to the Tumor Clinic by a private physician who, at the time of operation for elective hysterectomy, suspected a pregnancy of 2½ months' gestation and did no further surgery other than opening the abdomen. A biopsy revealed a Grade II epidermoid carcinoma. A Wertheim hysterectomy and node dissection were done by the Tumor Clinic staff and the patient was well 4 months postoperatively.

The second case is that of a 21-year-old woman, gravida ii, para i, who had a Grade I epidermoid carcinoma and was treated by hysterectomy and node dissection at 3 months' gestation. She was apparently free of disease 1 year postoperatively.

It is my opinion that the method of treatment, whether surgical or radiological, should depend somewhat on the stage of pregnancy. However, I would feel generally inclined to ignore the pregnancy in favor of immediate treatment of the carcinoma. In the first case presented by Dr. Thornton, I would have been rather hesitant to contemplate surgery of any kind on a patient so obviously a bad surgical risk.

The big problem, then, is one of diagnosis. To depend on clinical judgment is admittedly inadequate. A cytologic survey of all patients admitted to one's practice is at present not feasible. It behooves us to bear in mind that these patients do have epi-

dermoid carcinoma more commonly than is believed, and notwithstanding the fact that they are younger than the age group usually affected. If we do this, perhaps we will take more biopsies, and it follows that we will make more diagnoses.

DR. J. M. FLEMING, Spartanburg, S. C.—Epidermoid carcinoma of the uterus in pregnancy presents a more confusing problem than in nonpregnancy. This is a decision involving 2 human beings. I feel that we are still at a loss as to what is the correct treatment and I am sure I have no treatment to offer other than what Dr. Thornton has given in his paper.

I will present to you a case we have been observing in our clinic for the past 3 years. The patient was 39 years of age and was admitted to the hospital on Jan. 11, 1949. She was in hard labor and apparently at term. She had not seen a doctor and this was her fourteenth pregnancy. We were called because of excessive bleeding and the possibility of a placenta previa. On pelvic examination, a large cauliflower growth was observed presenting at the vulva. The patient was in hard labor and, while on the examining table, she expelled a large piece of this cauliflower growth and also a full-term baby. Pathological examination showed the growth to be epidermoid carcinoma, Stage III.

This patient had a normal puerperium and on the tenth day post partum, x-ray examination of the chest was made to see if there was any pulmonary metastasis. She was given x-ray treatment, which consisted of 2,054 r intravaginally and 4,896 r externally, a total of 6,950 r. In April, 1949, she was given 3,000 mg. per hour radium stem dose in the uterus and vaginally 2,850 mg. per hour, a total of 5,850 mg. per hour.

She has been checked at intervals and was last seen on Jan. 18, 1952. At that time, she showed no evidence of recurrence.

I am wondering if this could be the answer to treatment of epidermoid carcinoma of the cervix following pregnancy, also whether pregnancy should be interrupted.

I might say that it is my feeling that intravaginal radiation has a place in the treatment of all carcinomas of the cervix especially in epidermoid carcinoma of the cervix which is complicated by pregnancy. During pregnancy, it is my belief, the growth is faster and is more rapid than in the nonpregnant uterus.

In our hospital, we have had 8,284 obstetrical patients during the past 3 years and have found only 1 epidermoid carcinoma of the cervix.

## **THE RECOGNITION AND MANAGEMENT OF SEXUAL MALADJUSTMENT\***

ARTHUR N. BERRY, M.D., F.A.C.S., COLUMBUS, GA.

AS ONE matures both in years and in professional judgment, certain reticence and reluctance are displaced by a willing inquisitiveness regarding ill-defined complaints that do not readily fit into an easily recognized syndrome. The relationship between organic and endocrine patterns is becoming much more widely appreciated and, indeed, in recent years the term psychosomatic medicine has been given us. Our most common experience with this newly created term as gynecologists is perhaps in the realm of premenstrual tension. I should like to direct attention to a very similar and closely related symptom complex culminating eventually in "chronic pelvic congestion" and the complaints either proximally or distantly arising therefrom. The symptoms to which reference is made are those of premenstrual tension plus certain additional complaints. These include the following: increased pelvic heaviness, bearing down sensation, increasing dysmenorrhea, leukorrhea, increasingly heavy menstrual flow, pain in the lower abdomen, frequency of urination and dysuria, increased nervousness, irritability, headaches, depression, insomnia, emotional instability, gastrointestinal complaints, and cardiorespiratory symptoms.

It is my belief that these symptoms come about as a result of pelvic congestion due to repeated sexual stimulation without gratification, and, instead of being limited to the few to several days before onset of flow, may be present at all times, in greater or lesser degree. As may be seen, the symptoms may be grouped into two categories—pelvic or genital, and constitutional. Repeated sexual stimulation without gratification brings in its wake increasing pelvic congestion and increasing nervous tension. It is from the former source that gynecologic and urologic complaints arise that on examination show little or no organic pathologic substantiation. The more remote psychosomatic complaints come from the nervous tension of improper marital adjustment, increasing in severity with the passage of weeks, months, or years. For the woman of average emotional balance the insults to the psyche cannot go on indefinitely without unpleasant consequences. Lacking an understanding of the nature of these complaints, these women may be referred to either a psychiatrist or an internist with the general diagnosis of psychoneurosis. It is my contention that many of these women are sexually maladjusted and fall within the realm of gynecologic practice. I am neither equipped to discuss, nor does time permit a comprehensive survey of, the entire subject of sexual maladjustment. I shall confine my remarks to the subject of lowered libido or inadequate emotional satisfaction of libido—leaving out of consideration entirely the matter of true frigidity which I consider a psychiatric problem. I wish simply to arouse a greater awareness of an everyday problem and suggest a means of meeting this challenge.

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It is the exception rather than the rule to have a patient come in for examination complaining specifically of sexual difficulties. Indeed, most patients are grateful for having the subject mentioned so they can then discuss any problem of this nature. I have found the following plan of conduct helpful in my own practice, and at the expense of being considered extremely elementary should like to pass on the details of the handling of a patient presenting herself at our office. I believe the order of progression has been helpful, in that initial patient reticence is replaced by greater understanding and assurance of cooperation.

The history is taken in detail without reference to the matter of sexual compatibility or incompatibility, even when the evaluation of the history points strongly to this problem as the source of difficulty. Physical examination is then conducted and during the course of the pelvic examination the clitoris is inspected and palpated and inquiry as to the sensitivity of this organ is made. This is done in order both to ascertain the presence or absence of sensitivity and to fix in the mind of the patient this anatomical landmark. The vagina is inspected by speculum for evidence of normal moisture or undue dryness. When examination has been concluded and the patient is dressed and seated at the desk for discussion of the problems and findings, then and only then is an additional inquiry into sexual problems undertaken. At this point initial embarrassment has been circumvented and inquiry is met with eager truthful cooperation rather than with reluctant half-truths or falsification.

I shall not attempt to discuss the many factors relating to this personal problem. Husband consideration in preliminary love play, fatigue, fears of pregnancy, etc., are all matters of everyday knowledge that must be basically inquired into and explained. This is not to minimize the need of explanation, but at the present I am assuming the above matters are reasonably managed and that a difficulty still exists. I have found that an easy way to begin this discussion is to refer to the clitoris and explain that this is the organ of sexual sensitivity. In this regard the *Sex Manual* of Dr. Lombard Kelly<sup>1</sup> has been helpful.

Once the patient has admitted to a sexual problem we proceed to a more detailed discussion of the sensitivity of the clitoris, and, if this is lacking, what may be done about it. The desirability of proper conjugal contact is then illustrated and this is shown both improperly and properly performed, and an explanation is given for correction of an improper position. Attention to this detail alone is sufficient to overcome difficulty for some patients in whom there is normal sensitivity of the clitoris but who do not regularly reach a satisfactory climax. By far the greater number of patients require additional aid with this problem. As has been amply pointed out by Salmon,<sup>2</sup> these patients fall into two groups depending upon whether or not they have an estrogen deficiency. When estrogen deficiency is present coitus is unsatisfactory and orgasm cannot be obtained because of dyspareunia resulting from irritability and dryness of the vagina. In this type of case, full estrogen administration is necessary to remove local irritating factors and restore to the vaginal epithelium normal secretory ability and texture. Just as soon as a full estrogenic effect is obtained, testosterone should be administered. Patients without an estrogen deficiency,

in my experience, constituted by far the greater number of cases, and they are advised that hormone treatment is needed and that for the average patient twelve 25 mg. doses or six 50 mg. doses of testosterone in a three-week period are usually necessary. The patient is told that she alone can be the judge of a perfectly satisfactory response to treatment, as indicated by improved ease of stimulation and gaining of orgasm. When this stage of treatment has been reached, hypodermic medication is discontinued and an appointment for subsequent office examination and consultation is given, preferably within one week of the last injection. This time interval is important, as some oral medication must be promptly instituted before the benefits of the parenteral medication are dissipated. In a few instances, 300 mg. have been insufficient and 30 days from the giving of the first injection a second series is started and given in part or totally as required.

That this problem constitutes a not inconsiderable part of my own practice is indicated by Table I. It is thus seen that one patient in four to seven admits to a problem of this sort sufficiently severe to warrant hormone treatment. Not all of these patients have any volunteered complaint, but the matter of maladjustment is brought out in history taking and examination. I submit to you that this is a large enough group to merit our attention and consideration.

TABLE I

New gynecologic cases, June 1, 1949, to Dec. 31, 1950	949
Number admitting maladjustment	138
Percentage admitting maladjustment	14.6
New gynecologic cases, Jan. 1 to Dec. 31, 1951	601
Number admitting maladjustment	152
Percentage admitting maladjustment	25.2

We have recently used the aqueous free crystalline testosterone suspension, 25 mg. four times a week or 50 mg. twice a week, in preference to the preparations in oil. Previously we tried testosterone propionate in oil but had some incidence of urticaria. This complaint has largely disappeared since we have used the aqueous free crystalline suspensions of testosterone, indicating allergic reaction to the vehicle rather than to the therapeutic agent.

Testosterone, being a male sex hormone, acts in cases treated on the foregoing indications by producing a heightened susceptibility to psychic and somatic sexual stimulation, by an increased sensitivity of the external genitals, especially the clitoris, and by inducing a greater intensity of sexual gratification.<sup>3</sup>

Recognized constitutional effects of testosterone include stimulation of the bone marrow, raising of the basal metabolic rate, and induction of nitrogen, sodium, and water retention. The retained nitrogen is transformed into protein with resultant increase in body weight.<sup>4</sup>

As the hormone is a male sex hormone, the unpleasant side effects are just what one would expect—acne, hirsutism, coarsening of the voice. In the doses given, it has caused the latter complaint in marked degree once to my knowledge. This patient consulted another physician because of hoarseness, did not explain that she was being treated by me with testosterone, and was given sev-

eral doses of penicillin for a sore throat. The voice change subsided in a few days, but penicillin was given the credit for improvement. There have been a few instances of hirsutism or increased hirsutism. Indeed, I make it a point to note carefully any facial hair before starting therapy. Appearance or aggravation of this finding is more common in brunettes than in blondes, and we must today be especially on our guard for this complaint because of current information in the lay press regarding the problem. Hirsutism has not been extreme and has regressed in a matter of weeks to a pretreatment level when the drug is discontinued.

Acne is a more frequent symptom. It makes an appearance in mild form in about 5 to 10 per cent of cases, but promptly disappears when exhibition of the drug is stopped. We feel it is unwise to use a male sex hormone at all in cases with a severe pre-existing acne.

At the office examination at the conclusion of parenteral therapy, well over 50 per cent of patients show a decided hypertrophy of the clitoris and definitely increased sensitivity is present in 85 to 90 per cent of the patients. This finding of hypertrophy is at variance with the findings of many observers. It is generally accepted that doses considerably in excess of those used by us are necessary to produce hypertrophy of the clitoris, but this has been noted in fully one-half of the cases treated in which 300 mg. were given in 30 days.

At this point we explain that the oral therapy is generally necessary to sustain the effect of the hypodermic series just concluded. For the patient who has had an estrogen deficiency, a combination of oral androgen and estrogen may be given (10 mg. methyl testosterone and 0.05 mg. ethinyl estradiol daily). If the amount of testosterone must be increased, estrogen dosage should be increased proportionately. For the larger group of cases without estrogen deficiency, a labial tablet of the drug is given and the patient is advised to use one daily for 2 to 3 months, then less frequently for 3 to 4 months, gradually tapering off. The preparation currently prescribed by us is a 4 mg. testosterone Membrette (free crystalline testosterone). Methyl testosterone or testosterone propionate for labial, buccal, or sublingual use is apparently equally as effective. If the above plan does not maintain excellent adjustment the dose is stepped up, but, should prompt return to good response not take place, the patient is advised to return for a few more injections of the drug and then is placed on a somewhat larger oral dose for maintenance. Wafers for use by the sublingual, labial, or buccal routes are composed of either methyl testosterone, pure crystalline hormone, or testosterone propionate in propylene glycol. Absorption is slow and complete. Utilization of the hormone is considerably more efficient when it is given in this manner than when it is absorbed from the intestine with the consequent partial inactivation by the liver.

In our office practice, vaginal smears to study the vaginal cytology in these cases have not been employed. The inclusion of such a study would be a wise addition to therapy, but time does not permit the personal preparation and study of stained slides.

Results generally have been uniformly excellent. An accurate statistical follow-up is not available. To secure these data from individual office records

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would be a Herculean task. Based purely upon impression over a period of about 5 or 6 years, it is my belief that 75 to 80 per cent of the patients treated have had complete relief of symptoms. Another 10 to 15 per cent have experienced partial relief, and I estimate that there has been failure in perhaps 5 per cent. In the group that attained excellent results, all symptomatic complaints related to maladjustment were relieved, whether one or several and whether local or constitutional in nature.

In the group gaining partial relief, some residual complaint remained, but this group admitted to a definitely improved sexual response and a reduction of symptomatology.

The group classified as failure alleged no improvement in sexual adjustment but some in this group admitted a favorable tonic effect. Perhaps in the group of failures incomplete estrogen priming was a factor. I am confident that vaginal cytology in this group would be an extremely valuable aid in diagnosis, and therefore in instituting more accurate treatment and procedures.

There have been several patients who have returned volunteering that after an initial good adjustment they were again in need of further treatment because of gradual return of symptoms of maladjustment. Response to treatment in this group has been consistently good, and oral medication was recommended more regularly than that previously used by the individual. I know of five or six instances where failure resulted in which husband cooperation was totally lacking, and I know of no hormone which will supplant proper devotion and consideration on the part of the spouse. I am confident that this therapy has made some so-called psychoneurotic women adjust more normally and I know of other cases where marriage headed for the divorce courts has been happily salvaged.

### Summary and Conclusions

A symptom complex is presented arising from sexual maladjustment. This psychosomatic disorder is similar to that of premenstrual tension, but is not limited to the premenstrual phase of the cycle. It is symptom producing in greater or lesser degree throughout the entire cycle. This symptomatology is indeed an exaggerated or prolonged premenstrual-tension-like syndrome. Symptoms may become exaggerated by each sexual contact not culminating in coital pleasure or orgasm. That it is not an identical complex is supported by our knowledge of severe premenstrual tension in many patients who are completely well adjusted in their marital status.

The literature contains not infrequent reference to improvement of marital adjustment as a side effect to therapy with testosterone administered for other primary indications. Greenblatt<sup>5-8</sup> makes frequent reference in his writings to the stimulating effect upon libido. He has reported the use of testosterone chiefly by pellet implantation. This method of administration is a surgical procedure and while generally entirely satisfactory has limitations of application.

The therapy outlined in this presentation is a simple office procedure and is directed *per se* at treatment of the sexually maladjusted patient. There are few reports in the literature recording treatment with testosterone by hypo-

dermic injection where the primary indication for the drug was sexual maladjustment and related tension effects. Such a plan is presented. Perhaps in the near future use of a new androgen, testosterone "B" cyclopentylpropionate, whose action is prolonged far beyond that of testosterone propionate, will minimize frequency of injections and the necessity for prompt follow-up oral medication.

We feel that in properly selected cases the approach to this problem is simple and results of treatment are gratifying. Hormone therapy, when indicated, gives generally excellent results with a minimum of unpleasant and dangerous side effects.

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MEDICAL ARTS BUILDING

## **PREMENSTRUAL TENSION AND ITS RELATIONSHIP TO WATER METABOLISM\***

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**M**ENSTRUATION rarely appears unannounced. Signs and symptoms which herald its approach are experienced by many women. In order of frequency these symptoms are breast fullness, abdominal bloating, lumbar and low abdominal pain, nervous irritability and anxiety states, headache, and thirst. Menorrhthalgia is the term suggested by Hamblen to describe this symptom complex.

The syndrome has long been recognized. Hippocrates described it quite well and said he thought it was due to "agitated blood" seeking its channel of escape at the uterus. A report published in the first decade of this country indicated on the basis of police records of Paris a striking increase in the criminal acts of women during the premenstrual week.

### **Etiology**

There can be little doubt that the symptoms of premenstrual tension are related in part to abnormal water metabolism. In 1933, Thomas reported two cases of unusual edema recurring cyclically during the premenstrual period. Associated with edema in these cases were severe headaches, abdominal fullness, leg pains, coma, and convulsions. These symptoms, he observed, disappeared with the diuresis occurring at the onset of menstruation.

That this disturbed water metabolism is related in some manner to ovarian steroid secretion seems probable. It has been suggested that too much estrogen lies at the root of the trouble, but this is doubtful because the syndrome is not exaggerated but rather relieved by the administration of estrogen. It is the result of too little progesterone, says Morton, but the administration of progesterone does not relieve the symptoms. Furthermore, patients with premenstrual tension, like those with dysmenorrhea, menstruate from a well-developed progestational endometrium. It should be recalled that water storage during the premenstrual period is physiologic; only when tissue hydration is excessive do these symptoms appear.

The symptoms can be reproduced in part during the corpus luteum phase of the normal cycle by the daily administration of Pitressin. Water storage up to 4 pounds has been artificially induced in some patients and many of the symptoms of premenstrual tension simulated. This is not to say that increased endogenous vasopressin is the intrinsic factor causing the symptom complex, it only suggests that some vasopressin-like toxin may be the culprit.

Perhaps the entire syndrome is only a manifestation of adaptation to physiologic stress, as Selye might suggest. The adrenal corticoid excretion may be somewhat increased during the premenstrual week and it is well known that the edema following cortisone administration is associated with something of the same symptoms. These observations provide interesting avenues of speculation about the etiology of premenstrual tension, but speculation only.

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### Water and Electrolyte Metabolism in the Rat

Water to the amount of 5 c.c. per 100 grams of body weight was given to a group of rats. These rats were placed in cages, four animals to each cage, and the excreted urine from the four animals collected over a period of four hours. It is possible to recover 104 per cent of administered water in such an experiment, water itself being something of a diuretic. In an attempt to simulate the water storage of premenstrual tension, each animal was given 0.5 unit of Pitressin subcutaneously in addition to the oral water. Only 37 per cent of the administered water was recovered in four hours.

Ammonium chloride and the androgenic hormone testosterone propionate have been commonly employed in the treatment of premenstrual tension. An attempt was made to evaluate the effect of these substances on the water-logged rat. Ammonium chloride was given to the rats in a dose of 0.1 Gm. per kilogram and following this 34 per cent of the administered water was recovered. Testosterone in a dose of 5 mg. was given intramuscularly at 4 P.M. on the day preceding the test, and repeated at test time, and water recovery in these animals was 23 per cent.

Chloride excretion as measured by the Volhard-Harvey method was measured. Animals receiving water alone excreted 24 mg. of total chlorides per cage of four rats in four hours. Animals receiving water and Pitressin excreted 68 mg. The ammonium chloride-treated animals excreted 82 mg. and the testosterone-treated animals excreted 52 mg.

A new compound, Pyrilamine 8 Bromo Theophyllinate, a drug with known antivasopressin properties was tested. This compound was administered to the rats in a dose of 0.1 Gm. per kilogram and 92 per cent of the administered water was recovered in four hours. Even more significant was the excretion of total chloride. The animals receiving this drug excreted an average of 102 mg. of total chloride in four hours.

### Water and Electrolyte Metabolism in Women

Three hospitalized women volunteered to cooperate in the study of water and chloride metabolism. The patients were aged 22, 27, and 32 years, respectively. They were patients who had been subjected to no surgical trauma and who had no medical or surgical illness. They received no food or water after 9 P.M. preceding the test day. On the following morning, each patient was given 1,000 c.c. of fluid and at the same time received 10 units of aqueous Pitressin subcutaneously. The bladder was emptied by catheterization and the catheter left in place and connected to a bedside bottle. The urine was collected over a period of four hours. Following the water and Pitressin, the three patients excreted an average of 177 c.c. of water. On the following morning each of the three patients received the 1,000 c.c. of water and the 10 units of Pitressin, but in addition were given 200 mg. of the compound Pyrilamine 8 Bromo Theophyllinate. The average urine output in a four-hour test period was 1,010 c.c.

It is apparent from these figures that this compound is able to block the water storage effect of Pitressin almost completely.

### Clinical Study

A study was made on twenty-two patients with premenstrual tension. The duration of symptoms before menstruation in this group was about seven days, the shortest period being two days and the longest thirteen days. In all patients the symptoms reached a crescendo just before or during the first few hours of the menstruation, to be relieved at or near the onset of flow. A daily weight chart was kept by sixteen of these patients, all of them suffering rather severe

symptoms of premenstrual tension. The average weight gain in the premenstrual period was 5.2 pounds. These patients were advised to follow a salt-restricted diet and given a dose of ammonium chloride, 1 Gm. four times daily, for seven to ten days before the expected menstruation. Strict adherence to this regime produced only partial symptomatic relief in these patients. The average premenstrual weight gain in the group so treated was 4.3 pounds. Many of them complained about the salt-restricted diet and the majority complained of gastric irritation from the large doses of ammonium chloride.

Twenty-two patients, including the sixteen who had previously been tested with ammonium chloride, were subsequently observed. This was a group with severe symptoms, in fact four of the patients were more or less incapacitated each month for several days before menstruation. Without treatment the average weight gain for the group during the premenstrual time was 6.8 pounds, the largest individual gain was 11.5 pounds, and the smallest 4.2 pounds.

An attempt was made to record an intake and output during the cycles in which they were under study but the inevitable error arising from the patients' failure to note their fluid intake and output accurately made the results of doubtful value. Therefore, body weight was used as the measuring rod. The patients were given this compound in a dose of 50 mg. three or four times daily starting about ten days before the menstruation and terminating at the onset of menstruation. The average weight gain while under treatment was 1.4 pounds. Symptomatic relief rather closely parallels the diminished water storage.

### Conclusions

Premenstrual tension is a symptom complex related to abnormal water storage during the premenstrual period. It is essentially a water toxemia. Intensity of symptoms varies directly with the amount of water stored. Symptoms are severe when premenstrual weight gain exceeds 5 pounds.

The etiology of this disturbed water metabolism is unknown but appears to be related to some ovarian-pituitary-adrenal gland complex. It may be the result of some vasopressin-like toxin, possibly the menotoxin that is known to be present in the premenstrual and menstruating endometrium. In a study group of twenty-two patients with severe symptoms the average weight gain was 6.8 pounds. This abnormal water storage could not be blocked by testosterone nor by ammonium chloride, but was effectively blocked by a new compound, Pyrilamine 8 Bromo Theophyllinate.

Pitressin-induced edema in rats could not be unblocked by testosterone, or ammonium chloride, but was effectively unblocked by this compound.

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### Discussion

DR. J. R. KIGHT, Norfolk, Va.—Dr. Bickers, in his opening remarks, has emphasized the significance of this condition occurring during the latter part of the menstrual cycle, known as premenstrual tension. He mentions that in one study a review of police records shows a

striking increase in criminal acts of women during the premenstrual week. This is not surprising to physicians who have had occasion to deal with individuals exhibiting symptoms characteristic of this illness in a severe degree.

Dr. Bickers has given a very vivid description of the symptom complex that occurs in all degrees of severity and presents many clinical patterns. On more than one occasion, patients have admitted to me, on questioning, a fear of becoming insane. A pathetic case is that of the mother who expresses a strong sense of guilt because of her inability to tolerate the normal boisterousness and playfulness of her children. It would be impossible to determine the number of cases, but surely there must be many, in which an inability to cooperate, due to extreme irritability, has resulted in divorces and frequent occupational dismissals. Unusual as it may seem, it is not rare for these individuals, having experienced these symptoms at regular intervals over long periods of time, to fail to associate them with menstrual function.

The importance of this periodic development of tension has never been significantly emphasized, and physicians are only dimly aware of the consequences resulting from the irritability and lack of patience experienced by some women during this period of the menstrual cycle. Therefore, it seems most important that we, as physicians, being aware of the numerous symptoms that may exist and patients' failure to note a periodic regularity, should more carefully investigate the possibilities of premenstrual tension as the causative factor where bizarre complaints are presented.

That an abnormal water retention exists seems to be an accepted fact. Why this water is abnormally retained remains the unanswered question. Frank suggests that it is due to high estrogen levels, Morton to defective luteinization of the corpus luteum, Biskens to a deficiency of vitamin B complex with consequent impairment of the liver, and the Smiths to the presence of a menstrual toxin. Dr. Bickers has stated that premenstrual tension is essentially a water toxemia, and the endocrine disturbance leading to this deranged water metabolism is unknown. After reviewing in recent literature the various opinions as to the etiology of this condition, I concur with his belief.

His statement that the syndrome of premenstrual tension can be reproduced in part during the corpus luteum phase of the cycle by the daily administration of Pitressin suggests that this action would take place only during that period of time when premenstrual tension would occur. Is it not true that Pitressin will cause a similar abnormal water retention during any phase of the menstrual cycle, and in any individual?

My personal experience in treating this condition, with few exceptions, has been limited to the use of sedation and ammonium chloride, the results having been only fair. Recently, I have utilized the method described by Morton, using chorionic gonadotropin, but because of the limited number of cases, and the time involved, no comment as to the results is justified. I shall look forward to trying this new drug described by the essayist.

## Original Communications

### BREECH DELIVERIES IN PRIVATE PRACTICE

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BY FAR the majority of statistics in articles written about breech presentation have been obtained from hospitals where the deliveries were accomplished by the entire staff, resident, active, and courtesy. Obviously, optimum results cannot be obtained from work performed under such conditions. Tompkins, in 1943,<sup>1</sup> reported the experiences of a group of certified specialists. Others have reported personal series of cases from private practice, for example, Hansen,<sup>2</sup> Schultze,<sup>3</sup> Ware and associates,<sup>4</sup> and Trites.<sup>5</sup>

#### Material

During the twenty-nine-year period from July, 1922, to July, 1951, 10,555 consecutive private patients were delivered through this office. The majority of the deliveries were accomplished by one individual (P. H. A.). Included are infants of all periods of gestation and twins. Four hundred seventy-one of the 10,555 produced 480 infants, who presented as breech. There were 44 sets of twins, one or both of which were breech. In 9 of these sets both presented as such.

The majority of patients with breech presentation, 401 or 83.8 per cent were delivered by the same man (P. H. A.). The remaining were handled by certified specialists associated with him. This is the largest series yet to be reported from private practice.

Guyer and Heaton<sup>6</sup> as well as Waters<sup>7</sup> have stated that it is practically impossible to compare the figures of various authors because of the many differences in standards. An attempt is made by the authors of this article to compare their results with those of others by using the same standards for each insofar as possible.

After reviewing the literature, Table I was devised to correlate the incidence of breech presentations listed by various authors, according to either the weights of the infants or the periods of gestation. Previous reports have paid little or no attention to these factors, resulting in wide variations of the quoted incidence of breech presentation. For purposes of comparison our personal series has been included.

For patients in all periods of gestation it will be noted that there is considerable variation from a low of 3.2 per cent to a high of 6.7 per cent. Averaging all of the figures in this group an incidence of 4.2 per cent is obtained which closely parallels our 4.3 per cent.

The groups of patients with babies weighing 1,500 grams or more have incidences of from 2.8 per cent to 4.1 per cent, the average being 3.3 per cent. This is considerably lower than our 4.3 per cent. Dennen and Fisher,<sup>8</sup> with

TABLE I. INCIDENCE OF BREECH PRESENTATIONS BY WEIGHT OF BABIES OR PERIOD OF GESTATION

AUTHOR	ALL PERIODS OF GESTATION	FIVE MONTHS AND OVER	1,500 GRAMS AND OVER	1,814 GRAMS AND OVER	2,000 GRAMS AND OVER	2,268 GRAMS AND OVER	AT OR NEAR TERM	BREECH PRESENTATION (PER CENT)
Morton	8,509							3.5
Potter et al.	23,916							3.2
Hansen	1,882							6.7
Cannell and Dadek	16,166							3.4
Waters	20,000							4.3
Guyer and Heaton	15,398							4.6*
Average								4.2
Arnot and Nelson	10,555							4.3
Danforth and Galloway	8,531							3.3
Moore and Steptoe		13,577						2.8
Meyer		10,224						3.1
Dennen and Fisher								4.1
Average								3.5
Arnot and Nelson	10,448							4.3
Ware et al.		6,746						4.4
Arnot and Nelson			10,312					4.1
Warwick and Lippett				17,638				2.4
Gustafson					2,922			3.7
Trites						5,987		3.8
Average								3.7
Arnot and Nelson					9,972			3.8

\*Excludes cesarean sections.

4.1 per cent, are close to our 4.3 per cent, while Moore and Steptoe's<sup>9</sup> 2.8 per cent and Meyer's<sup>10</sup> 3.1 per cent differ considerably.

There is one group of patients "at or near term" and one "at term." The former has an incidence of 3.7 per cent and the latter 3.8 per cent for an average of 3.7 per cent. This is practically identical with our 3.8 per cent.

Although this series of reports is much too small to base any conclusions upon, the averages given closely approximate ours with the exception of the "1,500 gram and over" group. It is a well-established fact that the incidence of breech presentation decreases as the patient approaches term. Thus with an average incidence of 4.2 per cent in the group of patients in all periods of gestation, and an average incidence of 3.7 per cent in the group at term, it would seem that the average incidence in the group with babies weighing 1,500 grams or more should be somewhere between 4.2 per cent and 3.7 per cent. Only Dennen and Fisher's<sup>8</sup> 4.1 per cent and our 4.3 per cent fall into that category. Moore and Steptoe's<sup>9</sup> 2.8 per cent and Meyer's<sup>10</sup> 3.1 per cent are considerably lower.

From this limited series of reports it can be said that the incidence of breech presentation in patients of all periods of gestation is around 4.3 per cent. For patients having babies weighing 1,500 grams or more it is around 4.2 per cent, and is 3.7 per cent in patients with term babies.

Our entire series of 10,555 patients was separated into groups that had babies weighing up to 1,500 grams, 1,500 to 2,000 grams, 2,000 to 2,500 grams and 2,500 grams and over. A similar procedure was used for the 471 patients with breech presentations. The incidence of each group has then been computed according to single deliveries, double deliveries, and parity.

As would be expected the highest incidence of breech presentation was in the group of patients with babies weighing up to 1,500 grams. The incidence decreases as the weights of the babies increase.

TABLE II. INCIDENCE OF BREECH BY INFANTS' WEIGHTS

INFANTS' WEIGHTS (GRAMS)	PARITY	TOTAL NO. OF DELIVERIES			NO. OF BREECH DELIVERIES			PER CENT BREECH DELIVERIES	
		SINGLE	DOUBLE	SINGLE + DOUBLE	SINGLE	DOUBLE	SINGLE + DOUBLE	SINGLE	SINGLE + DOUBLE
Up to 1,500	Primi.	57	7	64	10	2	12	17.5	18.7
	Multi.	39	4	43	4	2	6	10.2	13.9
	Total	.96	11	107	14	4	18	14.6	16.5
1,500 to 2,000	Primi.	80	13	93	8	6	14	10.0	15.0
	Multi.	40	3	43	7	1	8	17.5	18.6
	Total	120	16	136	15	7	22	12.5	16.1
2,000 to 2,500	Primi.	192	18	210	20	8	28	10.5	13.4
	Multi.	114	16	130	10	6	16	8.9	12.4
	Total	306	34	340	30	14	44	9.7	12.9
2,500 and over	Primi.	5,020	27	5,047	238	7	245	4.7	4.8
	Multi.	4,893	32	4,925	130	12	142	2.7	2.8
	Total	9,913	59	9,972	368	19	387	3.7	3.8

Table III is essentially the same as Table II except that the patients are separated into groups with babies (1) of all periods of gestation, (2) weighing 1,500 grams and over, (3) weighing 2,000 grams and over, and (4) weighing 2,500 grams and over.

In all four groups there are more primiparas than multiparas. This is in accord with the findings of the majority of other authors. Out of 550 cases Cannell and Dodek<sup>11</sup> found 332 primiparas and 218 multiparas, Potter and

associates<sup>12</sup> 455 primiparas and 331 multiparas for a total of 786. Dennen and Fisher<sup>8</sup> had 230 primiparas and 187 multiparas in 417 cases. Meyer<sup>10</sup> reports 261 primiparas and 184 multiparas in 455 patients. Of 859 cases Waters<sup>9</sup> found 508 to be primiparous and 351 to be multiparous. Morton<sup>13</sup> found 160 primiparas and 125 multiparas in 285 cases, while Ware and associates<sup>4</sup> had 192 primiparas and 99 multiparas out of 291 cases.

TABLE III. INCIDENCE OF BREECH BY GROUPS

PARITY	TOTAL NUMBER OF DELIVERIES			NO. OF BREECH DELIVERIES			PER CENT BREECH DELIVERIES	
	SINGLE	DOUBLE	SINGLE AND DOUBLE	SINGLE	DOUBLE	SINGLE AND DOUBLE	SINGLE	DOUBLE
<i>Group I: Patients With Infants of All Periods of Gestation</i>								
Primiparas	5,349	65	5,414	276	23	299	5.1	5.5
Multiparas	5,086	55	5,141	151	21	172	2.9	3.3
Total	10,435	120	10,555	427	44	471	4.0	4.4
<i>Group II: Patients With Infants Weighing 1,500 Grams and Over</i>								
Primiparas	5,292	58	5,350	266	21	287	5.0	5.4
Multiparas	5,047	51	5,098	147	19	166	2.9	3.2
Total	10,339	109	10,448	413	40	453	3.9	4.3
<i>Group III: Patients With Infants Weighing 2,000 Grams and Over</i>								
Primiparas	5,212	45	5,257	258	15	273	4.9	5.1
Multiparas	5,007	48	5,055	140	18	158	2.7	3.1
Total	10,219	93	10,312	398	33	431	3.8	4.1
<i>Group IV: Patients With Infants Weighing 2,500 Grams and Over</i>								
Primiparas	5,020	27	5,047	238	7	245	4.7	4.8
Multiparas	4,893	32	4,925	130	12	142	2.7	2.8
Total	9,913	59	9,972	368	19	387	3.7	3.8

As in Table II the incidence of breech presentation decreases as the weights of the babies increase. In the four groups of patients there is no more than 0.4 of 1 per cent difference between the incidences of breech presentation in the single pregnancy group as compared to the single plus double pregnancy group. Thus it appears to make not too much difference in the actual incidence, whether patients with twins are or are not included.

Beck<sup>14</sup> states that the average length of labor in primiparas is 16 hours for the first stage and 1.75 hours for the second stage, for multiparas 11 hours for the first stage and three-quarters of an hour for the second stage. Eastman<sup>15</sup> in *Williams' Obstetrics* concurs with Beck except that he gives a 1-hour second stage for multiparas.

Durations of labor in breech presentation as reported by various authors are given in Table IV. The lengths of labor in our series of cases are included for comparison. First and second stages of labor and their totals are listed when given. The table reveals wide variations in the various first and second stages of labor and their totals. This is undoubtedly due to many factors such as the type of analgesia used, method of delivery, attitude of the accoucheur, and the economic status of the patient.

It is interesting to note that the average of the other authors for the first stage plus the second stage of labor is 16.3 hours for primiparas, which coincides with our findings, and is 8 hours for multiparas as compared to our 8.7 hours. The first stage of labor in our primiparas was a little longer than the average of the other authors, while the second stage of our patients was shorter in both primiparas and multiparas. In our multiparas the first stage is practically the same as the average.

TABLE IV. AVERAGE DURATION OF LABOR IN BREECH PRESENTATION (IN HOURS)

	PRIMIPARAS		MUTIPARAS		MULTI- PARAS 1ST AND 2ND STAGES	MULTI- PARAS 1ST AND 2ND STAGES
	1ST STAGE	2ND STAGE	1ST STAGE	2ND STAGE		
Morton					16.4	10.6
Cannell and Dodek					15.0	12.0
Siegel and McNally					22.2	13.6
Trites					20.0	6.0
Meyer					17.5	11.5
Hansen	12.6	1.2	6.3	0.5	13.8	6.8
Vogt et al.	15.1	0.5	10.8	0.5	15.6	11.3
Ware et al.	9.0	1.5	8.0	0.7	10.5	8.7
Average	12.2	1.1	8.3	0.6	16.3	8.0
Arnot and Nelson	15.6	0.7	8.5	0.8	16.3	8.7
<i>Average Duration of Labor in Hours—All Presentations</i>						
Beck	16	1.7	11	0.75	17.7	11.7
Eastman	16	1.7	11	1.00	17.7	12.0

When the above statistics are compared with those quoted by Beck<sup>14</sup> and Eastman<sup>15</sup> it can be seen that the first and second stages are shorter in breech presentations, particularly in multiparas. This is contrary to the general impression that labors of patients with breech presentations exceed those with a vertex.

TABLE V. POSITION AND TYPE BREECH PRESENTATION

	PRIMIPARAS	MUTIPARAS	TOTAL	PER CENT
<i>Position.—</i>				
LSA	127	79	206	42.9
RSA	100	53	153	31.9
LSP	48	23	71	14.8
RSP	29	21	50	10.4
<i>Type breech presentation.—</i>				
Frank	201	130	331	69.0
Footling	90	33	123	25.6
Complete	13	13	26	5.4

Four hundred seventy-one patients were delivered of 480 babies that presented by breech. Their positions are recorded in Table V according to parity. The type of breech presentation is likewise recorded according to parity.

TABLE VI. POSITION AND TYPE (BY PER CENT) COMPARED WITH OTHER AUTHORS

	MORTON	CANNELL AND DODEK	SIEGEL ET AL.	AVERAGE	ARNOT AND NELSON
<i>Position.—</i>					
LSA	46.1	40.0	43.9	43.3	42.9
RSA	30.9	29.3	45.1	35.1	31.9
LSP	9.5	14.9	6.4	10.2	14.8
RSP	13.5	15.8	4.6	11.3	10.4
<i>Type breech presentation.—</i>					
Frank	67.3	64.1	55.6	62.5	69.0
Footling	26.9	32.1	35.0	31.5	25.6
Complete	5.8	3.8	9.4	6.3	5.4

The various incidences of the position and type of breech presentation as given by Morton,<sup>13</sup> Cannell and Dodek,<sup>11</sup> and Siegel and associates<sup>16</sup> are tabulated in Table VI and averaged for comparison to those of the authors. The figures of these authors mentioned are used because they include patients of all periods of gestation. Siegel and associates excluded twins.

The averages fairly well approximate the various incidences in our series. From these one might conclude that for position, the incidence of left sacroanterior is slightly below 45 per cent, right sacroanterior around 35 per cent, left sacroposterior around 10 per cent and right sacroposterior slightly over 10 per cent.

Our incidence of 69 per cent for frank breech appears to be high compared to the average of 62.5 per cent, while our incidence of 25.6 per cent for footling presentation is low compared to the average of 31.5 per cent. In complete breech the average of 6.3 per cent closely approximates our 5.4 per cent. One could generalize that frank breech occurs in below 65 per cent of the cases, footling breech in around 30 per cent, and complete breech in between 5 and 6 per cent of those patients with breech presentations.

Abdominal examinations are usually not performed until the seventh calendar month of gestation. Assuming the fetus weighs at least 2,000 grams at this time, including single and double pregnancies, 431 patients with breech presentations came under this category. The diagnosis of breech presentation was uncertain or missed 143 times by one or more men even after several examinations. The great majority of these were in primiparas, their tense, firm muscles preventing satisfactory palpation of the fetal poles in many cases. If there was any doubt as to the type of presentation a vaginal examination was done, and often this was not conclusive. X-ray examinations were not done on any of these patients. There probably would not have been as many missed diagnoses if it had not been for the war years. During this period there were 115 patients who were delivered of babies presenting by the breech. It was an impossibility for one man (P. H. A.) to examine these and other patients prenatally at regular intervals. Position was not everything in life in those hectic days. Morton<sup>13</sup> reports 118 missed diagnoses in 285 clinic patients. Thus it can be seen that a diagnosis of breech presentation can be difficult at times.

From the seventh month on an attempt was made to convert all breech presentations, except during the war years when time usually did not permit. If not successful, attempts were made on subsequent visits. No anesthetic was used, nor was any undue force exerted. The fetal heart was ausculted before and after each attempt. There were no complications that could be attributed to external version.

It is generally accepted that some 60 per cent of breech presentations are frank, and that external version of this type of breech is most difficult because of the splinting effect of the legs. Siegel and McNally<sup>16</sup> feel that a version should not be attempted if a frank breech is present, because of the danger of a resulting compound presentation. McCullough<sup>17</sup> has reported four cases of unrecognized frank breech presentation in which version resulted in compound presentations, the uteri rupturing in all four cases. Thus it would seem that in most cases conversion of a frank breech is both a difficult and dangerous procedure.

As it would be almost an impossibility to review the charts of 10,555 patients, the exact number of successful external versions in our series cannot be determined. Even if the exact number of successful and unsuccessful versions were known, without the aid of x-ray examination of each individual patient the various types of breech would remain unknown. As 69 per cent of the 431 patients with babies weighing 2,000 grams or more were frank breech, in view of what has previously been said it would seem that the greatest number of failures of external version must have been in this group, and the least number in the footling and complete breech group. The same could be said of spontaneous version.

After reviewing the literature we were unable to find any reference to presentations in which a knee or foot became impinged against the symphysis during labor. The condition was encountered five times, twice with a knee and three times with a foot. This impingement prevented descent of the baby until the knee or foot was freed and brought down.

It has been our practice to handle breech presentations in a most conservative manner. Unless there is a definite indication for induction, labor is allowed to start spontaneously. The Gwathmey type of analgesia was used in the early days of practice. This has been replaced by the use of sodium pentobarbital (0.2 solution) given in the early stages of labor, followed by Pantopon (0.02 solution) when the cervix is dilated 3 to 5 cm. If further medication is needed Demerol is the drug of choice. When full dilatation is reached the patient is moved to the delivery room, given nitrous oxide and encouraged to "bear down" with each contraction. The fetal heart is ausculted at frequent intervals. Any sign of fetal distress is an indication for continuous oxygen between pains and, if the distress is not remedied, the patient is immediately delivered.

Very few obstetricians apply forceps to a vertex presentation as soon as the cervix is dilated. This makes it difficult to understand why certain groups feel that extraction is indicated the moment full dilatation is reached in a breech presentation. Full dilatation is often difficult to determine and very frequently is not accomplished until there is considerable bulging of the perineum. Tragedy can result if an attempt is made to deliver an unmolded aftercoming head through an incompletely dilated cervix. Time spent in the second stage of labor is worth while for the paralyzing effect on the cervix.

As the perineum is distended by the descending breech, Novocain is infiltrated into the perineum. When further distention takes place an episiotomy is done. Right mediolateral episiotomies are usually done. With each contraction the patient is again urged to "push," following which descent and delivery of the breech usually occur promptly. The umbilical cord is loosened and carefully palpated for a pulse. At this point, to quickly and deeply anesthetize the patient is a procedure accepted by many. This we do not deem advisable as we prefer to have the patient use her contractions. The posterior arm is usually delivered first, although we frequently deliver the anterior arm first if the posterior arm tends to stick and resist delivery. However, if any difficulty is encountered a Potter maneuver is executed, bringing the shoulder and arm that were originally posterior to an anterior position. The head is then delivered with the aid of the Veit-Smellie-Mauriceau maneuver. Great care is taken to exert no downward traction on the neck. Gentle but firm downward pressure is exerted suprapubically and at right angles to the symphysis. At the same time the body of the baby is raised toward the mother's abdomen. Piper forceps to the aftercoming head are not used routinely. It was found necessary to use them in only 39 deliveries. Twenty-five of these were done by one man (P. H. A.), who uses the Piper forceps only when necessary, and fourteen by three associates who use them routinely.

TABLE VII. METHOD OF DELIVERY

	TERM				PREMATURE				TOTAL	
	PRIMIPARAS		MULTIPARAS		PRIMIPARAS		MULTIPARAS			
	EASY	DIFF.	EASY	DIFF.	EASY	DIFF.	EASY	DIFF.		
Spontaneous and assisted	170	39	107	21	48	6	31	2	424	
Extractions	6		2		1		0		9	
Decompositions	7		3		2		0		12	
Cesarean section	21		9		4		1		35	

Gordon's classification of the methods of breech delivery as quoted in an article by Warwick and Lippsett<sup>18</sup> is used by many authors. According to this classification, there are four methods of delivering breech.

1. Spontaneous and assisted breeches: those deliveries in which the fetus is allowed to deliver spontaneously up to the head. The head may deliver spontaneously or with the aid of a Veit-Smellie-Mauriceau or Wigand-Martin maneuver, or with forceps on the head.

2. Extraction: those deliveries in which the breech is a single or double footling and is delivered by traction on the feet, or in which the breech is frank and is delivered as such either manually or by applying forceps to the breech.

3. Decomposition: those deliveries in which the breech is frank and either one or both feet are brought down, usually by the Pinard maneuver.

4. Cesarean section.

Not all deliveries that fell into classification No. 1 were easy. Accordingly we further subdivided spontaneous and assisted breech deliveries into easy and difficult ones. Of the 445 babies delivered vaginally the majority, i.e., 424, were delivered by method No. 1. As would be expected, most of the difficult deliveries occurred in the patients at term. It was necessary to resort to extraction for the delivery of 9 babies and to decomposition for 12. The remaining 35 babies were delivered by cesarean section. From this it can be seen that our policy has been one of nonintervention unless it is definitely indicated.

There was a total of 436 patients delivered vaginally. Episiotomies were not done in 35 primiparas and 47 multiparas.

The majority of the episiotomies were right mediolateral. To illustrate the value of experience, the 436 deliveries were divided in half. There were twelve third degree lacerations in the first 218 patients delivered and only one in the second 218. Five of these were caused by extensions of median episiotomies in primiparas. In multiparas most of them resulted from failure to do an episiotomy. A marked decrease in the number of median episiotomies and a relative increase in the right mediolateral ones is apparent in the second group. As would be expected there were proportionately fewer episiotomies performed in the multiparas, and it will be noted that in the second group failure to perform an episiotomy occurred much less frequently than in the first.

TABLE VIII. EPISIOTOMIES AND PERINEAL LACERATIONS

	PRIMIPARAS					MULTIPARAS				
	EPISIOTOMIES			LACERATIONS		EPISIOTOMIES			LACERATIONS	
	NONE	MEDI- AN	RML	3RD°	2ND°	NONE	MEDI- AN	RML	3RD°	2ND°
First 218 deliveries	20	24	94	6	7	33	5	37	6	2
Second 218 deliveries	15	7	109	0	7	14	9	69	1	4
Total	35	31	203	6	14	47	14	106	7	6

TABLE IX. CERVICAL LACERATIONS

	BILATERAL	RIGHT LATERAL	LEFT LATERAL	MIDLIN E POSTERIOR	TOTAL
Primiparas	13	22	21	3	59
Multiparas	2	6	5	0	13
Total	15	28	26	3	72

All cervices are routinely inspected immediately after delivery. Any lacerations, whether old or new, are then repaired. This is not done by many who state that it raises the morbidity rate. We have not found this to be so.

Although cervical lacerations very seldom bleed enough to require suturing, we feel that a routine repair often spares the patient surgery at a later date. Only fresh lacerations are listed in Table VIII; those sustained from previous deliveries are not included. Contrary to what might be expected there were fewer bilateral lacerations than unilateral ones. Primiparas had far more than multiparas.

TABLE X. INCIDENCE OF CESAREAN SECTION

AUTHOR	ALL PERIODS OF GESTATION	1,500 GRAMS AND OVER	1,814 GRAMS AND OVER	2,000 GRAMS AND OVER	2,500 GRAMS AND OVER	CESAREAN SECTION (PER CENT)
Cannell and Dodek	+					2.3
Hansen	+					3.1
Waters	+					2.3
Walsh and Kuder	+					0.5
Tompkins	+					14.0
Guyer and Heaton	+					2.2
Potter et al.	+					10.8
Arnot and Nelson	+					7.4
Dennen and Fisher		+				20.9
Arnot and Nelson		+				7.4
Ware et al.			+			15.5
Meyer				+		13.7
Arnot and Nelson				+		7.8
Trites					+	8.3
Arnot and Nelson					+	8.7
Average (Arnot and Nelson figures excluded)						8.5

The incidence of cesarean section varies greatly when tabulated according to authors. Here again the standards vary according to the weights of the babies. This, however, should not make too much difference as most cesarean sections are done at or near term. The lowest incidence, 0.5 per cent is reported by Walsh and Kuder<sup>19</sup> from New York Hospital and the highest, 20.9 per cent by Dennen and Fisher<sup>8</sup> from New York Polyclinic Hospital. Our incidence of 7.4 per cent, for patients in all periods of gestation is fairly close to the average 8.5 per cent of the series listed in Table X. This is in accord with our experience, in that we try to strike a happy medium between too-radical and too-conservative management of breech presentation.

TABLE XI. INDICATIONS FOR CESAREAN SECTION

<i>Primiparas</i>	
Contracted pelvis with disproportion	
Generally contracted typical	5
Funnel	3
Simple flat	2
Prolonged labor with no progress 24 to 48 hr. (1 elderly primi.)	7
1½ cm. dilated after 19 hours active labor	1
Prolonged second stage of 2 hours (1 elderly primi.)	2
Fibroid blocking pelvis—infant less than 1,500 grams	1
Poliomyelitis—in Drinker respirator except at time of surgery	1
Elderly primiparas	
18 days overdue—unengaged breech	1
Long-standing sterility	1
Severe pre-eclampsia	1
Total	25
<i>Multiparas</i>	
Repeat sections	8
First baby dead—patient 41 years old	1
Pre-eclampsia	1
Total	10

The indications for cesarean section are listed in Table XI. There were 25 primiparas and 10 multiparas. Ten of the primiparas had contracted pelvis, and ten had tests of labor. The advanced age of a primipara was used only twice as an indication for cesarean section, and only then because the patient was overdue and labor could not be induced with castor oil. The other two elderly primiparas were given tests of labor before they were submitted to surgery. Eight of the ten multiparas had repeat sections. The one fetal death occurred in the patient with a fibroid blocking the pelvis, and the baby was nonviable, weighing less than 1,500 grams. There was one maternal death which will be discussed elsewhere.

The use of bags is a most controversial subject. In the days before antibiotics there were many indications for their use. Since this time the indications are fewer. While a great number of present-day obstetricians feel that they have no place in obstetrics, the authors feel that in certain selected cases they are often helpful. Any procedure that, without undue danger, will avoid the necessity of a cesarean section is certainly worth while. A few of the occasions in which they are occasionally used in our practice are (1) marginal placenta previa, (2) premature separations of the placenta, (3) uterine inertia, (4) fulminating toxemias before the age of viability or a dead fetus and (5) prolapsed cord.

TABLE XII. INDICATIONS FOR USE OF VOORHEES BAG

<i>Patients With Term Infants</i>	
Central placenta previa	1
One week overdue, previous baby breech—deadborn	1
Eclampsia	1
Pre-eclampsia	1
Uterine inertia—4 cm. dilated after 24 hr. labor	1
Premature separation of placenta	2
<b>Total</b>	<b>7</b>
<i>Patients With Premature Infants</i>	
Pre-eclampsia	2
Eclampsia	2
Premature rupture of membranes, fever, no dilatation	1
Premature separation of placenta	1
Increased anti-Rh agglutinins (1948)	1
Prolapsed cord, infant dead before insertion of bag	1
<b>Total</b>	<b>8</b>

The indications for the use of bags in breech presentation are given in Table XII. Some of the indications that were valid in the early days of practice are no longer so. Certainly today a bag would not be used for the management of a central placenta previa. In this series of cases they were used about equally in primiparas and multiparas.

The complications listed in Table XIII are essentially the same as could be expected in a series of cases presenting by vertex. A word might be said about prolapsed cords. A few of the incidences reported by others are as follows: Danforth and Galloway,<sup>20</sup> 1.3 per cent; Morton,<sup>13</sup> 2.1 per cent; Ware and associates,<sup>4</sup> 3.3 per cent; Cannell and Dodek,<sup>11</sup> 0.5 per cent and Potter,<sup>12</sup> 1.7 per cent. The first three are advocates of noninterference insofar as possible, while the last two deliver the majority of breeches as soon as the cervix is completely dilated. Apparently the method of delivery has little to do with the number of prolapsed cords as there is a variation in the most conservative method from 1.3 per cent to 3.3 per cent and in the more radical method from 0.5 per cent to 1.7 per cent. We had 7 prolapsed cords for an incidence of 1.4 per cent with but one fetal death.

TABLE XIII. COMPLICATIONS

<i>Patients With Term Infants</i>	
Eclampsia	1
Pre-eclampsia	1
Placenta previa	2
Premature separation of placenta	5
Prolapsed cord	4
Myomata uteri	2
Ovarian cyst	2
Cardiac disease	1
Diabetes mellitus	1
Separation of symphysis	1
Peritonitis—both patients died	2
Hematoma of episiotomy wound	1
Total	23
<i>Patients With Premature Infants</i>	
Eclampsia	3
Pre-eclampsia	3
Premature separation of placenta	2
Prolapsed cord	3
Myomata uteri	3
Acute hydramnios	1
Total	15

As has been demonstrated previously, not all breech deliveries are easy, even some of the spontaneous and assisted ones have proved to be quite difficult. In the more difficult cases it is practically impossible to avoid occasional injury to the child. This happened 13 times, twice in premature babies and 11 times in those at term. Erb's palsy and fractured clavicles were the predominate injuries, but fortunately there was complete recovery in all cases. There was one case of fractured humerus. More injuries occurred in term babies than in premature babies.

TABLE XIV. BIRTH INJURIES

<i>Premature Infants</i>	
Fractured clavicle	1
Fractured humerus	1
Total	2
<i>Term Infants</i>	
Fractured clavicle	3
Erb's palsy	8
Total	11

The gross fetal mortality rate is explained in Table XV. Out of the 480 infants with breech presentations there was a total of 48 stillbirths and neonatal deaths for a mortality rate of 10 per cent.

Twenty-seven of these infants were nonviable, weighing less than 1,500 grams; all died. Guyer and Heaton<sup>6</sup> had the same experience in their nonviable infants. After eliminating this group, 453 infants remain who weighed 1,500 grams or more. Twenty-one of these died—a mortality rate of 4.6 per cent.

Twenty-five infants weighed between 1,500 and 2,000 grams of whom 4 died or were dead on hospital entry, a 16 per cent fetal mortality. Subtracting these, 428 infants are left who weighed 2,000 grams or over. Among these there were 17 stillbirths or neonatal deaths for a 3.9 per cent mortality rate.

There were 43 infants in the 2,000 to 2,500 gram group, 6 of whom died giving a fetal mortality of 14.1 per cent for this group. After subtracting these there remain 385 infants with weights of 2,500 grams or more, 11 of whom died with a resulting fetal mortality of 2.85 per cent.

TABLE XV. GROSS FETAL MORTALITY RATE

	CORRECTIONS	NO. OF INFANTS	STILL-BIRTHS AND NEONATAL DEATHS	TOTAL NO. OF INFANTS	TOTAL STILL-BIRTHS AND NEONATAL DEATHS	FETAL MORTALITY RATE (PER CENT)		
						PRIMI.	MULTI.	TOTAL
Totals				480	48	6.25	3.75	10.00
Up to 1,500 grams		27	27					
Remainder				453	21	3.09	1.54	4.63
1,500 to 2,000 grams		25	4					
Remainder				428	17	2.56	1.40	3.96
2,000 to 2,500 grams		43	6					
Remainder			11	385	11	1.82	1.03	2.85

Summarizing, the gross fetal mortality in infants of all weights is 10 per cent, for those weighing 1,500 grams or more 4.6 per cent, for those weighing 2,000 grams or more 3.9 per cent, and for term babies 2.8 per cent.

TABLE XVI. CASES ELIMINATED TO OBTAIN CORRECTED FETAL MORTALITY RATE

REASONS FOR ELIMINATION	WEIGHT OF INFANTS IN GRAMS				TOTAL
	0 to 1,500	1,500 to 2,000	2,000 to 2,500	2,500 +	
Nonviable alone	12				
Congenital defects	4	1	2	3	
No fetal heartbeat on hospital entry	5	2	1	2	
Premature separation of placenta	2				1
Placenta previa					1
Pre-eclampsia	1	1			
Eclampsia	1				
Prolapsed cord			1		
Myomata uteri	2				
Intrapartum infection			1		
	27	4	5	7	43

Forty-three of the forty-eight stillbirths and neonatal deaths were eliminated for the reasons listed in Table XVI. The majority of the patients in whom no fetal hearts were heard on hospital entry had macerated fetuses. Twenty-seven—more than half—of the fetal deaths occurred in the nonviable group weighing 1,500 grams or less. In the group of 16 weighing 1,500 grams or more, 6 fetal deaths were attributed to congenital defects, and 5 to the fact that there was an absent fetal heartbeat on hospital entry. The remaining 5 stillbirths and neonatal deaths were excluded because of pre-eclampsia, prolapsed cord, intrapartum infection, premature separation of the placenta, and placenta previa, their breech deliveries having nothing to do with their deaths.

The five fetal deaths resulting from breech delivery per se are tabulated in Table XVII. Four of the five infants had mothers who were primiparas. There was only one premature baby. All of the deliveries fell under the spontaneous and assisted classification, 4 being difficult and 1 easy. Three of the four primiparas had prolonged labors of 24 hours or over, with associated difficult labors. The majority (4) of the breeches were frank, the remaining one being a double footling.

The corrected fetal mortality rate is determined in Table XVIII. The 5 fetal deaths resulting from breech delivery per se, out of 480 infants of all periods of gestation, give a mortality rate of 1.04 per cent for this group.

## BREECH DELIVERIES IN PRIVATE PRACTICE

TABLE XVII. FETAL DEATHS RESULTING FROM BREECH DELIVERY PER SE

CAUSE OF DEATH	PRIMI.	MULTI.	WEIGHT OF INFANT (IN POUNDS)	TYPE DEL. SPONT.—ASSIST.		1ST STAGE	2ND STAGE	LENGTH LABOR	POSITION
				EASY	DIFF.				
Arms stuck—cord around neck and between symphysis; died within 10 min.; no autopsy	1		5 to 5½			1	29 hr. 50 min.	1 hr. 30 min.	LSA, frank
Head stuck in brim, lived 1½ hr.; no autopsy	1		9 to 11			1	2 hr.	10 min.	RSP, frank
Stillborn—heart heard one hour before delivery; no autopsy	1		7 to 14	1			9 hr. 45 min.	32 min.	RSA, frank
Cord around neck twice; 2 applications Piper forceps; died within 26 min.; no autopsy	1		6 to 4			1	24 hr.	1 hr. 4 min.	RSA, double footing
Died within 10 min.; autopsy—atelectasis	1		7 to 5			1	25 hr. 20 min.	1 hr. 53 min.	RSA, frank

TABLE XVIII. CORRECTED FETAL MORTALITY RATE

CORRECTIONS	NO. OF INFANTS	STILLBIRTHS AND NEONATAL DEATHS	TOTAL NUMBER OF INFANTS	TOTAL STILL-BIRTHS AND NEONATAL DEATHS	FETAL MORTALITY RATE (PER CENT)		
					PRIMI.	MULTI.	TOTAL
Totals			480	5	0.84	0.20	1.04
Remainder	Up to 1,500 grams	27	0	453	5	0.88	0.22
Remainder	1,500 to 2,000 grams	25	0	428	5	0.93	0.23
Remainder	2,000 to 2,500 grams	43	1	385	4	0.77	0.26
Remainder							1.03

Twenty-seven infants weighed up to 1,500 grams, and 25 weighed 1,500 to 2,000 grams. All stillbirths and neonatal deaths in these two groups were excluded for the reasons given in Table XVI, for a fetal mortality rate of 0 per cent. This leaves 5 fetal deaths in the 453 patients in the 1,500 gram or over group—a mortality rate of 1.10 per cent. Likewise the same 5 fetal deaths are left in the 428 patients weighing 2,000 grams or over, resulting in a mortality rate of 1.16 per cent.

One of the 43 infants in the 2,000 to 2,500 gram group was stillborn, giving a fetal mortality rate of 2.3 per cent. Correcting for these there remain 4 fetal deaths in the 385 patients with weights of more than 2,500 grams—a fetal mortality rate of 1.03 per cent.

To summarize, the corrected fetal mortality rate in those (1) weighing 1,500 grams or over is 1.0 per cent, (2) weighing 2,000 grams or over is 1.16 per cent, and (3) 2,500 grams or over, i.e., term 1.03 per cent.

TABLE XIX. FETAL MORTALITY RATE—GROSS AND CORRECTED

	ALL PERIODS OF GESTATION	FIVE MONTHS AND OVER	1,500 GRAMS AND OVER	1,814 GRAMS AND OVER	2,000 GRAMS AND OVER	2,268 GRAMS AND OVER	TERM	MORTALITY RATE (PER CENT) GROSS   CORR.
Potter et al.	+							17.4   9.6
Hansen	+							11.9   0.8
Cannell and Dodek	+							19.2   6.7
Waters	+							11.2   —
Arnot and Nelson	+							10.0   1.04
Guyer and Heaton	+*							31.0   4.5
Danforth and Galloway		+						18.8   —
Moore and Steptoe			+					—   12.8
Meyer			+					13.0   4.7
Dennen and Fisher			+					11.7   8.7
Morton			+					14.8   —
Tompkins			+					4.6   2.7
Arnot and Nelson			+					4.63   1.10
Ware et al.			+					5.4   2.7
Arnot and Nelson				+				3.90   1.16
Warwick and Lippsett					+			4.9   1.3
Trites						+		3.6   1.8
Arnot and Nelson						+		2.8   1.03

\*Excludes cesarean sections.

In an attempt to standardize the gross and corrected fetal mortalities of other authors with the period of gestation Table XIX was compiled. Our figures are included for comparison. Even when the patients are separated into groups according to periods of gestation there is a marked difference in the mortality rates. Here again the standards used in obtaining corrected fetal mortality vary with the different authors. In the infants of all periods of gestation our 10 per cent gross and 1.04 per cent corrected fetal mortality rates closely approximates those of Hansen<sup>2</sup> and Waters,<sup>7</sup> while Potter and associates,<sup>12</sup> and Cannell and Dodek<sup>11</sup> have considerably higher rates.

Tompkins<sup>1</sup> 4.6 per cent gross and 2.7 per cent corrected fetal mortality rate in the group of infants of 1,500 or more grams approaches our rate of 4.6 per cent and 1.10 per cent.

Ware and associates<sup>4</sup> and Warwick and Lippsett<sup>18</sup> in the groups close to 2,000 grams have a fetal mortality rate quite close to our gross 3.9 per cent and corrected 1.6 per cent.

In the infants at term Trites<sup>5</sup> reports a gross 3.6 per cent and corrected 1.8 per cent fetal mortality rate which favorably compares with our 2.8 per cent and 1.03 per cent.

The lowest fetal mortality rates occurred in infants of private patients, as reported by Hansen,<sup>2</sup> Tompkins,<sup>1</sup> Trites,<sup>5</sup> and Ware and associates<sup>4</sup> and these rates check fairly well with each other and with ours. With the exception of the series reported by Waters<sup>7</sup> and Warwick and Lippsett<sup>18</sup> which closely approximate the private groups, infants of clinic patients had much higher fetal mortality rates, and there were greater variations.

There were two maternal deaths in this series of 471 patients with breech presentations, resulting in a mortality of 0.42 per cent. Neither one of these two were our own private patients, both having been seen in consultation.

The first death occurred in the early years of practice, 1927. The patient was a 20-year-old primipara with a frank breech presentation in the right sacroanterior position. The delivery came under the spontaneous and assisted classification and was difficult. A median episiotomy extended into the rectum, following which the patient became septic and died of peritonitis. The baby weighed 6 pounds, 8 ounces and had an Erb's palsy of the right arm. Had antibiotics been available at this time the patient probably would have survived. In retrospect, as pointed out previously, this third degree laceration probably would not have occurred in the later years of practice when median episiotomies gave way to right mediolateral ones in breech presentation.

The second maternal death in 1939 was also a primipara, 23 years old, with a frank breech in the right sacroanterior position. A low cervical cesarean section was done, the indication being "nondescent of the breech after a two-hour second stage." Acute endometritis followed by peritonitis caused the patient's death on the seventh postoperative day. Had an extraperitoneal cesarean section or a decomposition of the breech been performed, or had antibiotics been available, this death might have been avoided.

### Comment

Any procedure that will lower fetal mortality is worth while. External version is one such procedure, and should always be attempted. It is doubtful if much permanent success can be obtained until around the seventh lunar month. If done prior to this the fetus is too small to remain fixed, and tends to constantly change position in the relatively large amniotic sac. Since the majority of breech presentations, i.e., 60 per cent, are frank in type it would appear that at the best there is about a 50 per cent chance for successful conversion.

The average vertex presentation is not a source of worry to the accoucheur. The opposite, however, is usually true when a breech is encountered. Considering the incidence of the latter to be around 4 per cent, it is evident that the average obstetrician cannot expect to become too proficient in their management. Forceps are not applied to a vertex the moment the cervix reaches full dilatation. It would appear that there is no more reason to deliver a breech as soon as the cervix is fully dilated. Just as in a vertex, a second stage is beneficial to the breech presentation, for the expulsive forces are from above downward. Any undue traction from below is most likely to result in extended arms. The majority of the low fetal mortalities are reported by those who favor conservative management.

Today, cesarean section is a much safer procedure both to the mother and the infant than before the days of antibiotics. The result has been that its indications have been broadened. Even so, it is not a procedure to be undertaken too lightly, for the patient is then usually condemned to laparotomy for subsequent deliveries. In these days of antibiotics surgery can always be safely resorted to after a fair and honest test of labor. In many doubtful cases, even those of elderly primiparas, the ease and rapidity of vaginal delivery are often astounding.

### Summary

Out of 10,555 consecutive deliveries in private practice 471 patients were delivered of 480 infants presenting as breech.

Our findings in breech presentation as regards incidence, duration of labor, positions, types, complications, birth injuries, weights of infants, period of gestation, incidence of cesarean section, fetal and maternal mortality rates are compared with those of others.

Missed diagnoses and external version are discussed.

Our methods of delivery are presented.

The indications for cesarean section and Voorhees bags are given.

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## **HEART DISEASE AS A COMPLICATING FACTOR IN PREGNANCY\***

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**A**SSESSMENT of the ability of the cardiac patient to achieve satisfactory parturition at term requires keen appreciation of the fundamental pathologic processes of heart disease together with fine integration of the factors involved in the normal gravid cardiopulmonary physiology. Besides, the management of the heart in pregnancy depends to some extent on the time when the patient first presents herself for care. As in any given case of any disease, no inflexible rules can be adhered to but the consideration of certain generalities is helpful to guide the progress of the maternal cardiac patient.

### **Incidence**

How important is the problem of heart disease in pregnancy? To answer this question with some reasonable degree of accuracy, perhaps the figure of 2 per cent (of all pregnant women) would be acceptable. In this significant minority group, one finds the mortality rate to be 500 per cent above that of noncardiac pregnancies. Or, otherwise stated, heart disease is the lethal lesion accounting for one-fourth of maternal deaths.

Its importance established, one then may analyze the specific types of heart disease involved in the accumulation of such formidable figures.

### **Types of Heart Disease Encountered**

Rheumatic heart disease is overwhelmingly predominant, to the extent of 95 per cent. As far as the valves are concerned mitral stenosis is the scourge, for it alone or in combination with aortic valvular lesions is found most frequently. Aortic lesions alone are third most common, and combined valvular involvements other than those already mentioned account for a mere fraction of the rheumatic problems.

Congenital anomalies account for 2 per cent of heart disease in pregnancy, while all other types together comprise the remaining 3 per cent. These include: (1) hypertensive, (2) syphilitic, (3) arteriosclerotic, (4) thyrotoxic, (5) infectious, (6) metabolic (beriberi) and (7) neoplastic.

One specific infectious cardiac problem arises frequently enough to warrant mention and that is subacute bacterial endocarditis, either active or as a sequela of the healed disease. A potential cardiac problem in pregnancy is that of the patient having had previous intracardiac surgery, such as mitral valvular commissurotomy.

### **Pulmonocardiac Physiology in Pregnancy (Load of Pregnancy)**

Tangible alterations in cardiovascular and pulmonary function occur normally with gravidity. Foremost of these is the definite increase in plasma volume (total blood volume) beginning early in pregnancy, increasing gradually from the twelfth to twenty-fourth weeks and rising sharply to about the thirty-

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fourth week. From that time on, an appreciable decline to half the initial increase may be observed. About a month before delivery, there will have occurred a 45 per cent increase above normal, followed by a drop to 30 per cent above normal at term. The downward trend prevails until normal non-pregnant levels are achieved post partum.

Exactly why this pattern obtains is not known, even though a positive salt balance occurs during gestation with a reversal of that situation toward the end of pregnancy and during the puerperium. Fluid retention in the tissues occurs simultaneously. Hemoglobin and erythrocytes become diminished per unit volume of blood, with an attendant lowering of the hematocrit and diminution of blood viscosity.

Circulation rate increases or, stated differently, the circulation time decreases, as has been corroborated by simultaneous oxygen-consumption and cardiac output studies. Oxygen consumption rises 15 to 25 per cent but cardiac output increases are disproportionately higher. Arteriovenous oxygen ratios range higher during pregnancy, too.

Cardiac output definitely increases and this, together with the volumetric increase of the circulation, presumably explains the increase in cardiac work. Higher cardiac output begins at the fourth month and is accelerated notably between the sixth and ninth lunar months. As much as 50 per cent increase over normal may be observed. A definite decrease appears during the last lunar month, with normalcy being restored several weeks following delivery.

Ordinarily, arterial blood pressure is not affected by pregnancy although at times both systolic and diastolic levels decline slightly between the fourth and ninth lunar months, with the diastolic level becoming the more noticeably depressed and producing an increased pulse pressure.

Venous pressure increases considerably in the femoral veins but remains unchanged in the upper extremities.

The basal heart rate is not altered significantly during pregnancy.

Total pulmonary ventilation rises considerably (to 50 per cent) while vital capacity increases slightly. The latter decreases immediately after delivery. Vital capacity increases because the subcostal angle widens and there is consequent widening of the chest (transverse diameter). Since this alteration of the thoracic cage occurs normally incident to pregnancy, the advent of reduced vital capacity becomes important as a reliable sign of early heart failure in a patient with a known cardiac lesion.

Less well-defined alterations of physiology also tend to affect the load of pregnancy. Weight gain implies additional tissue demands for circulation and increased muscular activity for locomotion. Musculoskeletal contours become altered, produce a shift in the center of gravity and cause considerable strain on the trunk musculature. Conceivably, certain individuals may suffer cardiac functional embarrassment because of unusual habitus or deformity, merely because of the size of the uterus, elevation of diaphragm, and cardiac displacement. None of these items lends itself to objective appraisal or mensuration.

Fetal factors affect the cardiovascular load of pregnancy. Rich vascular supplies are demanded by the gravid uterus. Possibly some of the circulatory changes of pregnancy may evolve because of large arteriovenous placental communications. If so, these would act as numerous arteriovenous fistulas and impose continuous amplified cardiac work.

To review, then, the most important cardiovascular load of pregnancy consists of: (1) blood volume increase, (2) accelerated rate of blood flow, and (3) a rise in the cardiac output. The eighth and ninth lunar months exhibit the maximum augmentations and are followed by decreases prior to term. The

factors mentioned predispose to cardiac failure, tolerated admirably by the normal heart but poorly borne by the diseased heart. Indeed, heart failure in pregnancy happens preponderantly during the periods of increasing and maximal physiological stress and diminishes directly as the burden lightens during the month prior to delivery.

Despite the inadequacies of suitable explanations for the functionally favorable environment (for the diseased heart) during the last lunar month, great therapeutic (prognostic) value hinges on the knowledge of the constancy of this peculiar circumstance. Similarly, it is all too apparent that heart failure in the first trimester, for example, can be expected to intensify significantly in the critical period between the sixth and ninth lunar months.

During the first stage of delivery (labor), less well-defined aberrations exist. Venous pressure elevations have been attributed to the effects of Ergotrate. Certain studies point to the temporary decrease of blood volume at delivery time followed by an increase beyond the original level during the first few days of the postpartum period and return to normal, nonpregnant values as a result of postpartum diuresis. Is this due to unique circulatory changes occurring during this period as a result of obliteration of an appreciable arteriovenous shunt in the uterus?

Vital capacity falls abruptly at delivery and is capable of inducing acute heart failure.

Recapitulating, then, the stresses of labor are tolerated well. For that patient who has progressed favorably during the neogenic phase of pregnancy, it is unusual to encounter heart failure initially during or immediately after delivery.

### **Effect of Pregnancy on the Heart**

*Cardiac Enlargement.*—Whether actual cardiac enlargement occurs during pregnancy is debatable. Theoretically, it is most attractive and enticing to assert that the increased blood volume, increased output, and increased work should be related reciprocally to myocardial hypertrophy. But the real demonstration of increase in cardiac mass during pregnancy is lacking. Cardiac silhouette enlargement may be caused just as readily by dilatation to accommodate the greater blood (plasma) volume. Diameters of the heart in pregnancy increase, but these usually are commensurate with corresponding enlargements of the entire thorax. Illusory enlargement of the heart may be the result of perceptible elevation of the diaphragm, displacing the pumping organ upward and transversely. Electrocardiographic features suggesting this mechanism usually are present.

*Cardiac Reserve.*—That pregnancy infringes on cardiac reserve is undeniable. To measure this encroachment, however, has been a problem defying acceptable solution to date. Practically, the importance of having satisfactory methods to measure this reserve is clear: which patient will have how much depletion of her reserve during the course of pregnancy and delivery? Intelligent management is predicated on the accuracy of such estimates.

*Heart Failure.*—Some observers have emphasized that fatal heart failure may occur post partum because of degenerative myocardial changes uniquely incident to the pregnant state. Nonspecific electrocardiographic abnormalities were present in those cases. On the other hand, many equally able clinicians with extensive experience in this field feel that such an entity is tenuous and that at best it is a syndrome which is rare and ill defined. We have not recognized any such cases in our clinic at Hahnemann Hospital.

Occasionally, a patient may present evidence of advanced congestive heart failure during pregnancy with recovery after delivery and will exhibit no objective evidence of organic heart disease.

*Disturbances of Rhythm.*—Neurogenic disturbances of cardiac rhythm, particularly premature contractions and paroxysmal atrial tachycardia, may be discovered during pregnancy but that they are related etiologically has not been proved. Their importance is slight and corrective therapy is not warranted except on rare occasions. Contrariwise, atrial fibrillation never occurs because of the pregnant state.

### Cardiovascular Symptoms and Signs in Pregnancy

Certain symptoms and signs are common to both the normal pregnant woman and the nonpregnant cardiac patient. Keen appreciation of their origin, obviously, is mandatory to avoid erroneous diagnoses, mostly in the direction of ascribing unjustifiably the label of "heart disease."

*Dyspnea.*—Dyspnea on exertion tends to be a major complaint of the normal pregnant woman, especially during the third trimester. It is due to increased total ventilation in excess of the more modest rise in vital capacity, which latter, as we have said, increases because of widening of the subcostal angles.

Orthopnea is not unusual normally.

Cardiac palpitation is common, with or without actual disturbances of rhythm (especially premature systoles). Heart consciousness during the night, accompanied by a choking sensation, may occur during pregnancy in the absence of heart disease. "Pseudoparoxysmal nocturnal dyspnea" has been applied to this phenomenon. Such an episode lacks wheezing respirations, cough, frothy or blood-tinged sputum in contradistinction to the nocturnal dyspnea of frank heart failure.

*Heart Rate.*—Mild tachycardia (10 to 20 beats per minute) often with a loud first sound in the mitral area simulating thyrotoxicosis is frequent. Hyperkinetic heart action may be misinterpreted as real tachycardia. Premature contractions are common.

P<sub>2</sub> often may be accentuated. Pulmonic systolic murmurs are almost constant (some authors say 100 per cent) findings during pregnancy. Mitral systolic murmurs are heard rather commonly. But diastolic murmurs are not attributable to pregnancy and should not be considered functional. Physiological third heart sounds are audible frequently, usually disappearing following delivery. The murmurs mentioned usually are blowing, grade 1 to 2, highly localized, and are susceptible to variation with alterations in respiration and posture.

*Vascular Changes.*—Dilatation of the veins of the chest and abdomen is usual in the late months of pregnancy. A collapsing type of pulse and sometimes true capillary pulsations seem to occur normally.

The problem of heart enlargement is deceptive and bedside appraisal of heart size generally is impossible. Radiologic study is needed to evaluate this factor. Lordosis incident to pregnancy causes prominence of the upper left cardiac border and may simulate the pulmonary salient convexity noted in rheumatic mitral valvular disease.

*Edema.*—Uterine enlargement tends to increase venous pressure in the pelvis and thence in the lower extremities. Edema produced by this mechanism is observed regularly during pregnancy. Evidence of increased venous pressure in the upper extremities (with prominence of cervical veins) does not occur in the absence of congestive heart failure. Persistent basal or posttussive râles are not due to normal pregnancy.

### Laboratory Studies

*Electrocardiography.*—Left axis shift (15 degrees), occasionally with a prominent Q<sub>s</sub>, is the pattern observed in the later months of pregnancy.

Benign T-wave inversion in the precordial leads has been observed to return to normal following delivery.  $T_3$  inversion seems to have no especial portent. Knowledge that these aberrations do occur in the course of normal pregnancy is insurance against the misdiagnosis of coronary artery disease.

*Hematology.*—Leukocyte counts may rise somewhat, but the erythrocyte count is lowered consistently. Hemoglobin and hematocrit values fall below normal. The erythrocyte sedimentation rate becomes elevated considerably.

### Recognition of Heart Disease in Pregnancy

As noted above, the evidence pointing toward heart disease in pregnancy may be difficult to obtain and its interpretation problematical. The need for correlation of all data is obvious. Even then, it is not always possible to ascertain conclusively whether organic heart disease exists. Borderline cases in that category, however, are not crucial problems of management because they probably would not develop significant cardiac derangement if under careful supervision (for example, a patient with a well-defined mitral systolic murmur and equivocal heart enlargement).

In pregnancy, the most important signs indicating organic heart disease are the presence of a diastolic murmur and/or definite cardiac enlargement. If this involves a specific chamber, that information is even more helpful, for it may suggest a specific valvular or congenital lesion, particularly if other corroborative signs are detectable.

Overzealousness to diagnose organic heart disease in the face of features characteristic of the normal variants of cardiovascular physiology in pregnancy seems to us to be a major source of error. It is helpful to remember that the final appraisal of systolic murmurs of appreciable intensity often profitably and wisely must be deferred until the postpartum period.

### Prognostication in the Pregnant Cardiac Patient

To determine which cardiac patients merit no especial concern because of their pregnancy and which ones present major therapeutic problems, is the most difficult of the tasks of evaluation. There is no satisfactory method for measuring cardiac reserve in a given patient. Since pregnancy encroaches formidably on this reserve, it is painfully evident that one must deal realistically with unknowns. Only the employment of general principles learned by physiopathologic studies tempers our almost complete ignorance on the question, "How will this particular patient fare?"

Functionally, the classification of the New York Heart Association is most helpful for estimating the cardiac risk beginning with the first trimester of pregnancy. The classification:

1. Patients with cardiac disease and no limitation of physical activity.
2. Patients with cardiac disease and slight limitation of physical activity.
3. Patients with cardiac disease and marked limitation of physical activity.
4. Patients with cardiac disease who are unable to carry on any physical activity without discomfort.

Using this classification, one finds that most fatalities fall within groups 3 and 4, with a low mortality rate in groups 1 and 2.

Factors other than functional capacity obviously enter into prognostications of this type. Such a listing as points 1, 2, 3, and 4 provides no guide for weighing these items, i.e., heart size, the existence of arrhythmias, the pres-

ence of rheumatic activity, or the duration of the heart disease. To circumvent this inadequacy, Hamilton and his group make use of a listing comprising patients exhibiting either or both a diastolic murmur and cardiac enlargement. These patients are considered "favorable" whereas others with: (1) historical or frank heart failure, (2) arrhythmias, (3) major concomitant disease (diabetes, nephritis, or tuberculosis) are "unfavorable."

Contrast the 2.3 per cent mortality rate of those termed "favorable" with the 16.7 per cent incidence of the "unfavorable"! Atrial fibrillation boosts the mortality to 33½ per cent!

The "unfavorable" group warrant closer inspection.

*History of Previous Heart Failure.*—That failure should recur with the added burdens of pregnancy might be anticipated. On the other hand, if a previous pregnancy were not complicated by failure, it is unreasonable to assume that it cannot occur during this one. Parity per se has doubtful significance.

*Functional Status.*—Reduced functional capacity and frank heart failure early in pregnancy are dangerous signs. Mortality figures in this group range high.

*Degree of Structural Damage.*—Appreciable cardiomegaly augers ill for the pregnant woman. Size alone seems important. Authoritative opinions differ as to the significance of the combination of mitral-aortic lesions.

*Disturbances of Cardiac Rhythm.*—Atrial fibrillation seems to be the arrhythmia causing the most vital concern. Consequent to this, heart failure is common and death rates increase.

*Duration of Rheumatic Disease.*—Rheumatic heart disease of long duration tends to mean increased risk during pregnancy, merely because the patient is approaching the final phase of her cardiovascular lesion.

Rheumatic activity occurring during pregnancy is rare. If rheumatic carditis can be diagnosed unequivocally, probably termination of the pregnancy before the sixth lunar month is indicated.

*Age of the Patient.*—With increasing age, the rheumatic cardiac patient is progressively more likely to develop heart failure. Beyond 35 years, age increase is reflected in sinister statistics.

*Concomitant Diseases.*—Diabetes, hypertension, nephritis, or tuberculosis render the prognosis even more serious, naturally.

Most of the factors enumerated owe their importance not to their intrinsic significance but to the fact they imply the advanced or final phases of rheumatic cardiovascular disease. Actually, pregnancy in no way alters the natural history of the disease. Pregnancy encroaches on the reserve, but if gestation proceeds without heart failure, maternal morbidity or longevity is unaffected. Repeated pregnancies, likewise, have not been shown to alter maternal life statistics of rheumatic individuals, so long as heart failure is absent during pregnancy, delivery and puerperium. There are, of course, unfortunate individual exceptions to this rule.

*Subacute Bacterial Endocarditis.*—Subacute bacterial endocarditis occurs oftener following delivery—within 3 to 4 months. If it does supervene during pregnancy, there is a somewhat increased maternal mortality rate, even under modern therapy. Appropriate (intensive and protracted) antibiotic administration lessens the hazards and termination of pregnancy usually is *not* warranted. Actually, the problems of postinfectious heart failure are more troublesome now (since the advent of antibiotics) than those of infectious endocarditis. Normal pregnancy with uneventful delivery has been reported following clinical cure of subacute bacterial endocarditis. However, further pregnancies should be

viewed in the light of the new types of complications following the cure of subacute bacterial endocarditis.

Prophylactic penicillin therapy just prior to delivery and throughout the postpartum period would seem a rational and justifiable precautionary measure to employ in the treatment of patients with rheumatic or congenital heart disease.

*Embolism.*—Embolism, frequently associated with congestive heart failure, is an ominous complication. "Unfavorable" group patients are the ones who tend to develop this lesion.

*Fetal Mortality.*—One-half the patients in the least "favorable" classification suffer loss of a viable fetus. Delivery during the last month of pregnancy enhances considerably the possibility of obtaining a live baby. This possibility is further increased by the choice of vaginal delivery as opposed to cesarean section.

### Contraindications to Pregnancy in Heart Disease

The preceding undesirable lesions can serve as basic criteria mitigating against pregnancy either contemplated or extant. Mature reflection on the pertinent factors involved in each decision is mandatory, and while sympathetic attention to personal, economic, social, or religious considerations is proper, actual professional decision should be based exclusively on the medical aspects of the problem. It is the duty of the physician to explain the implications of the medical recommendations, but final acceptance of the chosen risk falls to the lot of the patient. Should an additional liability be assumed because of the choice of the patient, it behooves the physician to employ every possible technique to attempt to conclude the pregnancy successfully.

Those patients in the favorable group present few problems. Heart disease adds little to their pregnancy risk and results tend to be favorable. Notwithstanding, pregnancy in the earlier years of womanhood is advisable for these patients because the likelihood of heart failure increases with the mere passage of time. Multiparas in this group, despite the absence of eventful pregnancies, may be advised to have no further pregnancies. Under certain circumstances during the first trimester, interruption of pregnancy may be justifiable.

Sterilization is a corollary to interruption of pregnancy, although at times the additional danger of this procedure may preclude its performance. Sterilization may be avoided, too, if the reason for interruption is an acute, reversible illness and there is the logical assumption that a future pregnancy under less stress may be borne satisfactorily. This is an especially important consideration with first pregnancies (nulliparas).

### Heart Failure Occurring During Pregnancy, Delivery, or Post Partum

*Incidence.*—Congestive heart failure is the most serious cardiac complication in pregnancy and the commonest cause of death. When the circulatory load of pregnancy is maximum—between the seventh and ninth lunar months—its incidence is highest. Only occasionally will failure appear before the sixth month. It is equally unusual to encounter initial heart failure during delivery or post partum. If such does happen, the probability of death is great. Unprecedented heart failure during delivery or post partum generally is due to toxemia, infection, or anemia.

At the time of delivery, the increased work associated with a difficult labor, obliteration of the placental arteriovenous anastomoses, and sudden decrease in vital capacity are phenomena contributing substantially to heart failure. Additional undisclosed factors probably are active.

*Recognition.*—Symptoms and signs common to both the normal and the cardiac pregnant woman pose the difficult problem in regard to the establishment of a diagnosis of congestive heart failure. Exertional dyspnea, orthopnea, transient basal râles, fluid retention, and edema are clinical features often observed with the physiological load of pregnancy. Contrariwise, they may signify congestive heart failure. Astute interpretation of their correct meaning requires keen observation and much experience.

Dyspnea of a degree disproportionate to the normally anticipated increase in pulmonary ventilation is a sign suggesting heart failure. Cough apparently not due to respiratory tract infection, especially worse on exertion, is a reliable sign of failure. Or, acute paroxysmal dyspnea with pulmonary edema may be the initial sign of heart failure. Usually this unprecedented, dramatic onset of decompensation is due to acute left ventricular failure because of aortic insufficiency. Mitral stenosis, particularly unsuspected, often manifests itself in this spectacular fashion.

Diminution in vital capacity typifies early congestive heart failure, whereas normally in pregnancy one observes a tendency to increased vital capacity. Determination of these values may not be practicable, however, so resort to the more reliable objective sign of persistent basilar râles is made. During pregnancy, the blood (plasma) volume increases and this trend is augmented by heart failure, to produce pulmonary congestion. Basal râles therefore constitute an early sign of decompensation.

Progressive weight increase in a short period of time or a sudden weight gain often is a forerunner of more precise evidence of heart failure. Mercurial or resinous diuresis may confirm the impression of more occult failure.

An enlarged, tender liver always is a significant finding.

Persistent tachycardia (110 beats per minute) with tachypnea (24 respirations per minute) during labor suggests incipient heart failure which demands instantaneous alleviation.

*Precipitating Factors of Heart Failure.*—Each increment of physical activity in the area between the point of tiredness and the point of fatigue is infinitely more important from the standpoint of myocardial durability than the units comprising the quantum from rest to tiredness. It is not surprising, therefore, that fatigue or excessive physical exertion is the commonest precipitating cause of heart failure during pregnancy. Second, excessive oral or parenteral fluid intake and last, respiratory tract infection account for the advent of failure. Unpretentious upper respiratory infections—"colds"—may lead to sudden, disastrous congestive failure in a patient with rheumatic heart disease!

*Prevention of Heart Failure.*—Since allowances must be made for the physiological load of pregnancy, all measures must be applied to minimize the work of the heart if failure is to be prevented. These factors are paramount:

*Definite daily regimen.*: A satisfactory daily routine adjusted to the needs of the patient must be planned. The severity of the cardiac lesion and the functional status predetermine this. The situation of the pregnant patient at rest is comparable to that of the nonpregnant woman performing moderate work. Rest requirements average 10 nocturnal hours and a period at midday. Light housework is permissible, but the more strenuous physical tasks should be avoided (washing, ironing, spring housecleaning). Shopping tours should not be indulged in. *Fatigue must be avoided.*

The appearance of any new or unusual symptom should be reported to the physician, e.g., upper respiratory infection, cough, hemoptysis.

Rigid adherence to these rules is mandatory and it is incumbent upon the physician to explain intelligibly the need for observance of the program.

During the third trimester, during the period when the physiologic load is maximal vigilance should be the keynote.

*Frequent visits to the physician:* Weekly private or clinic visits are in order for the pregnant cardiac patient when significant lesions are present. Such visits assure reasonable control of the patient, allow for determination of individual limitations, and facilitate earliest recognition of impending heart failure.

Disheartening liberalization of management occurs unless a stringent watch is kept on the patients. Unfortunately, too, heart failure may have become rather advanced before it is discovered unless frequent interviews and examinations are planned. The variability of time and type of complications under more liberal plans invite tedious or disastrous problems of therapy. Hospitalization for several weeks prior to term may be quite desirable.

*Control of predisposing factors:* Weight gains of over 15 pounds during pregnancy are not advisable. A diet characterized by high protein, moderate carbohydrate, and low fat content will help to restrict advances in weight. Adjuvant medication in the form of vitamins, calcium, and iron should be almost routine to maintain a favorable nutritional balance. From the sixth lunar month on, salt restriction should be practiced. Possibly prescription of cation exchange resins might allow liberalization of the salt intake under certain circumstances (i.e., problems of anorexia).

Once again, may I emphasize that in the normal pregnant woman, many of the items about which we become somewhat apprehensive in the pregnant cardiac woman, are without any great importance. But attention to these minutiae in a patient with definite cardiac disease looms all-important. They represent very real hazards and require decisive, prompt control.

Any extracardiac factor augmenting the load should be eliminated. Whereas the pregnant cardiac woman is concerned, the effect of two burdens appears to be greater than their actual sum.

Finally, diligent care has proved extremely worth while in the management of the "favorable" group, by contributing to a reduction in the incidence of decompensation and lowering of the maternal mortality rate. No such results have been achieved by *any* method of management in the "unfavorable" class.

*Treatment.*—Congestive heart failure in pregnancy implies the use of the same corrective measures as in decompensation encountered under any other circumstance. Briefly, bed rest, 1.0 Gm. salt diet, digitalization and mercurial or resinous diuretics are the current mainstays. There is some question as to the advisability of allowing unrestricted fluid intake in pregnancy (as would normally be allowed with sodium restriction) because of the peculiar tendency to fluid retention and increased circulatory blood volume. Limitation of oral or parenteral fluids must be practiced to avert the definite possibility of inducing congestive heart failure or pulmonary edema.

Heart failure existing, the patient should remain at bed rest, preferably under hospital conditions, until satisfactory conclusion of the entire pregnancy.

Acute pulmonary edema, which possibly may be recurrent either during pregnancy or during delivery, requires the instantaneous use of morphine. Supportive measures include: (1) oxygen inhalation, (2) rapid digitalization, (3) intravenous aminophylline and (4) appropriate diuretic therapy, with (5) minimal salt intake to prevent further lapses. Venesection may be a lifesaving measure in the event the foregoing therapy is inadequate.

#### The Management of Heart Disease in Pregnancy

The most gratifying management of heart disease in pregnancy (heart disease complicated by pregnancy, or pregnancy complicated by heart dis-

ease—depending on one's viewpoint) can be attained only by enthusiastically integrated cooperation of the obstetrician and the internist-cardiologist.

**First Trimester.**—During the first few months of pregnancy (before the physiological load assumes significance), heart failure spells either maternal or fetal death. Interruption of pregnancy is indicated as soon as a genuine effort to control failure has been made. Within the first trimester, curettage is the technique of choice.

**Second Trimester.**—Between the third and fifth lunar months, abdominal hysterotomy is the accepted method of termination if heart failure has occurred. Tubal sterilization often is done at the same time.

Absence of congestive failure usually implies an uneventful delivery. With decompensation, delivery by any method is an extreme hazard. If heart failure is uncorrected or unalleviable, the mortality rate is prohibitive.

**Third Trimester.**—To empty the uterus not only does not ameliorate frank heart failure but actually intensifies the degree of cardiac insufficiency. Therefore, if failure ensues between the sixth and ninth lunar months—during the period of increasing physiological load—the most advisable recourse is to vigorously treat the decompensated heart medically with the goal of maintaining a satisfactory functional capacity, until the load of pregnancy automatically becomes eased (with improvement of functional status) at the final month. In the above circumstance, it is unwise to interrupt the pregnancy prior to term unless a second major complication—such as severe toxemia—supervenes to provide a specific indication for abrupt termination.

**Labor and Delivery.**—Well-established procedures obtain in the management of labor in cardiac patients. The orthopneic position is advocated for use during labor and delivery, whereas the Trendelenburg position is contraindicated.

Appropriate, adequate sedation is indicated to lessen apprehension and to allay pain during the periods of uterine contractions.

Shortening the second stage of labor judiciously is important. Determination of the optimal time for this is a matter of mature obstetrical judgment. Remember that a persistent pulse rate of 110 and respiratory rate of 24 constitute cause for the diagnosis of incipient heart failure requiring definitive therapy. The choice of anesthetic agent is far less important than the competence of the anesthesiologist.

**Post Partum.**—Attentive observation of the patient immediately following delivery is important because of the inherent danger of sudden onset or aggravation of heart failure within this period, especially in patients who experienced some cardiac difficulty during pregnancy.

Early ambulation is unwise. A hospital sojourn of several weeks is desirable to recover a quantum of cardiac reserve. Parenteral alimentation should be administered cautiously.

**Lactation.**—Circulatory demands seem to be increased by lactation but this has not been established clearly. Empirically, it seems accepted practice to disallow lactation if a significant cardiac lesion has been demonstrated.

**Method of Delivery.**—It is not feasible to compare satisfactorily the stress of vaginal delivery with the strain imposed by cesarean section. Section had been considered preferable for the patient with severe heart disease until recently, when a statistical review of both types showed that the mortality rate was lower when the normal route was employed in the patient with severe heart disease. Pelvic delivery seems to be tolerated well by the cardiac invalid. Revision of previous tenets has resulted in the generally current opinion that hysterotomy should be a procedure reserved for use on purely obstetrical grounds without regard for the cardiac status at term, except for severe hypertension or toxemia.

### Special Problems in Heart Disease Other Than Rheumatic

*Congenital Heart Disease.*—No more than 2 per cent of all cardiac lesions encountered in pregnancy are congenital in type. Cyanosis due to congenital lesions constitutes a highly unfavorable sign for assuming the risks of pregnancy. Noncyanotic congenital lesions are less formidable and appraisal there rests upon the nature of the defect, the degree of cardiac enlargement and the patient's functional capacity. Appreciable cardiomegaly and severe reduction of functional efficiency are unfavorable prognostic features.

*Coarctation of the aorta:* Coarctation of the aorta is unique in that during labor the eventuality of rupture of the aorta is inherent. That being so, coarctation is considered an indication for cesarean section.

*Shunt lesions:* Parturitional fatalities occasionally are due to congenital cardiac defects which permit a shunt between the cardiac chambers or the great vessels, such as a patent interventricular septum or a patent ductus arteriosus. Clinically, shock develops suddenly, with tachypnea and tachycardia; congestive failure is not apparent. This catastrophe is thought to be produced by reversal of the blood flow through the abnormal communication, resulting in a right-to-left shift initiated by the sudden release of peripheral resistance at the time the uterus is emptied. It seems this sinister complication is more prone to follow cesarean section than vaginal delivery. Some feel binding the limbs and abdomen immediately after delivery of a patient with a shunt lesion aids in restoring peripheral resistance and minimizes the hazard.

*Bacterial endocarditis:* Bacterial endocarditis is a constant threat to the patient with a congenital heart lesion. In pregnancy, this possibility must be borne in mind. Prophylactic administration of antibiotics during labor and the puerperium should be routine.

*Hypertensive Cardiovascular Disease.*—The effect of pregnancy on essential hypertension is enigmatic because of the lack of suitable data from which to draw valid conclusions. Whether pregnancy alone aggravates the course of hypertension or whether toxemia also must be present is unknown. That toxemia develops more frequently in individuals exhibiting prior hypertension is agreed generally.

Hamilton believes the prognosis of mild hypertension is approximately the same as noted in the "favorable" group of patients having rheumatic heart disease. Those having severe hypertension with definite evidence of cardiac involvement—as indicated by enlargement and diminished functional capacity—show the significantly higher mortality rate of the "unfavorable" rheumatic group. Definite progression of hypertensive disease during pregnancy may constitute an absolute indication for interruption even in the face of an appreciable and increasing physiological load.

*Toxemia of Pregnancy.*—Nonconvulsive toxemia of pregnancy with hypertension, edema, and albuminuria occasionally may be complicated by acute paroxysmal dyspnea and pulmonary edema thought to be on the basis of acute left ventricular failure. Although such an episode may arise in women with no pre-existing renal or vascular disease, it is more usual in those having recognized hypertension antedating pregnancy. Some observers question the cardiac origin of this complication, pointing out the fact that pulmonary edema may appear in the course of pre-eclampsia alone with generalized edema, no increase in blood volume, and no venous distention.

If one assumes the pulmonary edema associated with severe eclampsia is due primarily to left ventricular failure, then certainly immediate, full digitalization is in order for all patients having eclampsia. Additional therapy includes morphine (or Demerol), venesection or peripheral hemostasis, dehydration and prompt delivery.

*Mitral Valvular Commissurotomy.*—Mitral valvular commissurotomy performed during pregnancy, followed by uneventful, successful delivery at term, has been accomplished both by Brock and by Rumel. Through the courtesy of Drs. W. R. Rumel, P. R. Cutler, J. R. Miller, and M. S. Sanders, we have been informed in detail of the progress of their patient, delivered April 18, 1952. Apparently there is no reason to fear recommendation of mitral valvular commissurotomy during pregnancy provided the orthodox indications for that procedure are present.

At least a score of patients have undergone mitral valvular commissurotomy (by the technique of Bailey, first accomplished June 10, 1948), later have become pregnant, and then have been delivered at term without event.

No other types of intracardiac surgery ever have been attempted during pregnancy, as of this writing.

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## A SURGICAL APPROACH TO INTRACTABLE PRURITUS VULVAE

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THIS brief discussion is in the nature of a preliminary report of the results obtained utilizing a new application of an old plastic procedure. This series of 12 cases represents a group of women with extensively treated, very long-standing, completely intractable pruritus vulvae. All of this group were surgically treated by wide undermining of the skin of the vulva, vaginal mucous membrane, and anus, with extension outward into the skin of the thigh, perineum, and upward over the symphysis and groin area. The immediate objective of this method of attack is partially to denervate the entire area and thus cause a temporary loss of sensory sensation, and improve blood supply to the skin and cutis of the entire vulval region. Physicians faced with necessity of relieving stubborn, unruly pruritus vulvae have tried countless nostrums both locally and by subcutaneous injection, as well as vitamin, psychic, and x-ray therapy, in the past 50 years. These methods have resulted in varying degrees of success and many claims have been made as to the efficiency of each and all types of treatment. Medical literature contains volumes extolling the virtues of every method used. The following report deals with only those cases in which there has been complete failure of the above-mentioned measures, and which, in addition, show no dangerous pathological problems such as neoplastic disease or leukoplakia. Probably all gynecologists and dermatologists have encountered a few such frustrating problems, treated by large numbers of physicians all using a different approach and all resulting in complete or partial failure. To date, the only surgical approach has been vulvectomy which has been employed as a last-resort measure, although not extensively, in intractable pruritus of this area in the absence of malignant skin changes and leukoplakia. Vulvectomy has been a desperation measure, is mutilating, commonly results in dyspareunia, tightening of the skin, ectropion of the mucous membrane of the vagina with subsequent ulceration, excoriation, or fissuring, particularly at the fourchette; neither has it accomplished the desired purpose, which is to relieve constant skin and mucous membrane irritation of the entire vulvovaginal area. The following operation has been devised as a simple surgical procedure to replace vulvectomy and to restore to health the skin of the vulvar area and mucous membrane of the lower third of the vagina.

In the absence of specific findings for direct treatment, the most successful forms of therapy heretofore have been psychic, high vitamin intake, especially of vitamin A, and subcutaneous administration of absolute alcohol, procaine aqueous or in oil, and local use of heat. X-ray therapy has proved valueless,

\*Presented March 4, 1952, before the Pittsburgh Obstetrical and Gynecological Society.

indeed, so often exaggerating the symptoms that the majority of roentgenologists shy away from these cases, and many firmly decrie the practice of exposing these tissues to roentgen rays.

Encouragement to devise a helpful surgical technique to alleviate pruritis and other sensory sensations in this area followed extensive experience in skin grafting, pedicle flap and tube pedicle construction during the late war from 1944 to 1946. It was evident to me that unhealthy skin improved when shifted to cover other areas, always providing enough of its blood supply was preserved. It was also noted that temporary anesthesia was often produced in large areas; thus, the well-known plastic principle of delaying flaps and tube pedicle grafts to increase circulation locally before shifting, applies in principles to this operation, the main objectives being to create temporary anesthesia of the site, and improve vascular supply to interrupt the following "vicious cycle."

#### "The Vicious Cycle"

Regardless of unknown factors underlying intractable pruritus vulvae, such as produced in the initial stages of fungus or parasitic infestations, whether by *Monilia*, *Trichomonas*, pediculosis, or low-grade inflammatory reactions in the hair follicles and sebaceous glands, some such cases will either fail to have satisfactory treatment instituted early, or will fail to respond to proper measures and the skin remains in a constantly irritated state. The patient scratches continuously and superficial excoriations develop. A low-grade inflammatory process is usually present in the subcutaneous tissue as a result of continuous trauma and the skin responds by showing deep fissuring, thickening, sealing, and sometimes loss of pigmentation, infection of the hair follicles, edema, and a generally unhealthy appearance. This may be followed by more serious disease, such as malignant change or leukoplakia requiring radical excision, but the usual appearance and skin biopsies do not show these two serious pathological changes. Many of these women are adversely affected mentally and the psychic trauma can often reach serious proportions even to contemplation of suicide. The usual picture will show a nervous and psychoneurotic type of individual who may easily control symptomatology during the daytime, but who gradually succumbs to the desire to scratch at night, thereby losing much needed rest. Eventually the general health factor is markedly affected by loss of sleep and constant worry, followed by extreme nervous tension. The "vicious cycle" is pruritus, scratching, worry, loss of rest, and impairment of mental and physical function. It then becomes necessary to resort to more drastic treatment in an effort to restore the individual to a normal mental and physical state.

#### Indications

The criteria for performing the operation were necessarily made rather rigid. Each case must have had continuous pruritus for two years without relief by local therapy and no signs of leukoplakia, kraurosis, or malignancy. *Trichomonas*, pediculosis, *Monilia*, and diabetes were ruled out. Most were subjects in which the symptom syndrome had persisted much longer. Three had had fairly extensive x-ray therapy to the vulva. Five had had previous injections of absolute alcohol or procaine, or both. One had been treated with x-ray, alcohol, and procaine by subcutaneous injection. Psychic therapy, high vitamin intake, barbiturates at night, and penicillin therapy had been used previous to operation in seven subjects. The youngest was 28 years old, the oldest 62. Case 12 showed marked kraurosis with dyspareunia, pruritus, burning sensation be-

neath the cutis, and local discomfort when walking. The average duration of symptoms and treatment was 5½ years before operation. Only 3 patients were still in the menstrual life. Nine were postmenopausal.

### Technique

The procedure is simple and can be performed quickly. Blood loss and trauma are minimal, and the postoperative course unattended by serious complications. One incision is made about 4 to 5 inches in length at the junction

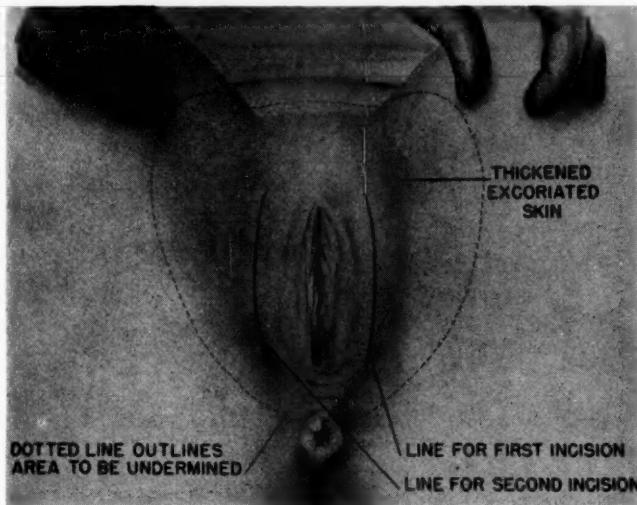


Fig. 1.—Original drawing depicting lines of skin incisions and area to be undermined.

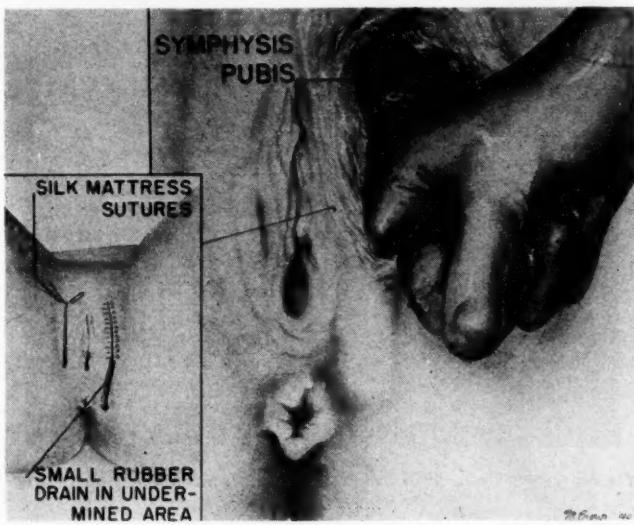


Fig. 2.—Method of undermining by combination sharp and blunt dissection. Insert, drainage and closure.

of the skin and labia majora, preferably in the deepest fold, and carried down to the fascia, preserving the subcutaneous areolar tissue as shown in Figs. 1 and 2. Using a combination of sharp and blunt dissection, the skin is widely undermined to include several inches of thigh, 3 to 4 inches outward into the

inguinal area; carried upward over the symphysis to a level well above the pubic bone; and downward around the rectum and over the perineal skin area. Medially, the mucous membrane of the vagina is undermined to a level exposing the bulbocavernosus muscles. Complete hemostasis is obtained and the same procedure repeated on the opposite side. When the dissection is complete, a



Fig. 3.—Preoperative appearance of Case 10 with continuous pruritus of 5½ years' duration.

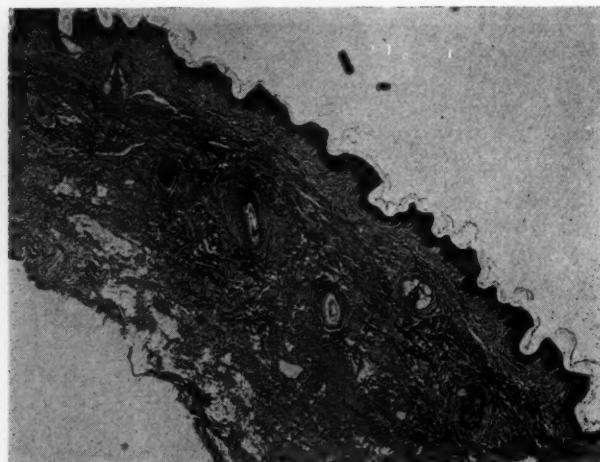


Fig. 4.—Section of skin from Case 10 taken from labium majus illustrating lack of abnormal microscopic changes.

good portion of the vagina and vulva can be lifted away from the surrounding tissues. Both fingers will meet in the midline well above the symphysis, beneath the perineal skin, and well around the anus. Drainage was at first thought to be unnecessary, but since one patient developed a fair-sized hematoma, has been routinely used. A small half-inch Penrose-type drain from which the gauze has been removed is laid over the symphysis on both sides and brought out the lower ends of the incisions. When it is certain there are no bleeding or exten-

sively oozing areas, a single layer of subcutaneous sutures is placed, 4 or 5 in all, and both skin incisions approximated with mattress sutures of fine silk. A light pack is placed in the vagina, a 5 c.c. Foley catheter in the bladder, and a special pressure dressing, shown in Fig. 9, is applied, using elastoplast adhesive which covers mechanics' waste or fluffed gauze to maintain constant pressure for 5 days. The average elapsed time to perform the operation was about 1½ hours (Figs. 5, 6, 7, and 8).

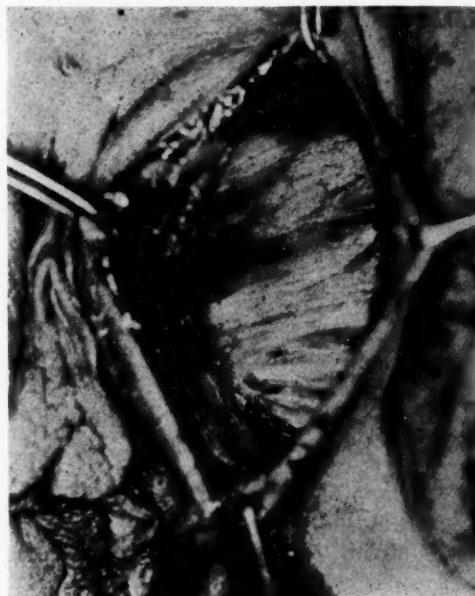


Fig. 5.—Actual photograph. Left-sided incision at junction of skin of left labium majus and thigh.

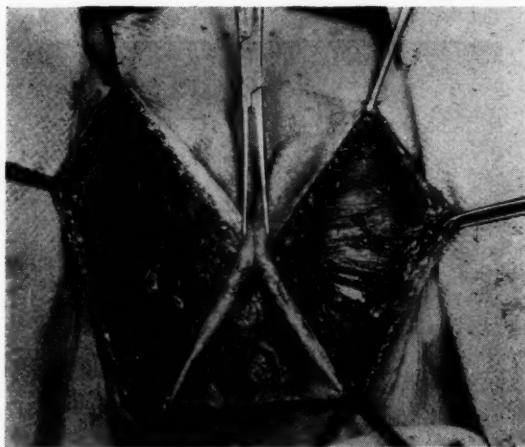


Fig. 6.—Both sides incised.

Preoperative preparation should stress an empty bowel. This obtained by a preliminary lavage by castor oil or citrate of magnesia, 24 hour liquid diet, and preoperative enema the night before the operation. Transfusion is used only in those cases with definite secondary anemia. The anesthesia used in all cases has been Pentothal without other agents except oxygen.

### Postoperative Routine

All patients are given 300,000 units of aqueous procaine penicillin twice daily. The catheter, which is brought through a circular window in the center of the dressing (Fig. 3), is released 3 to 4 times daily. Patients are kept on full liquids for 5 days until the pressure dressing is removed. The bladder is irrigated with sulfanilamide solution after each catheter release. The pressure

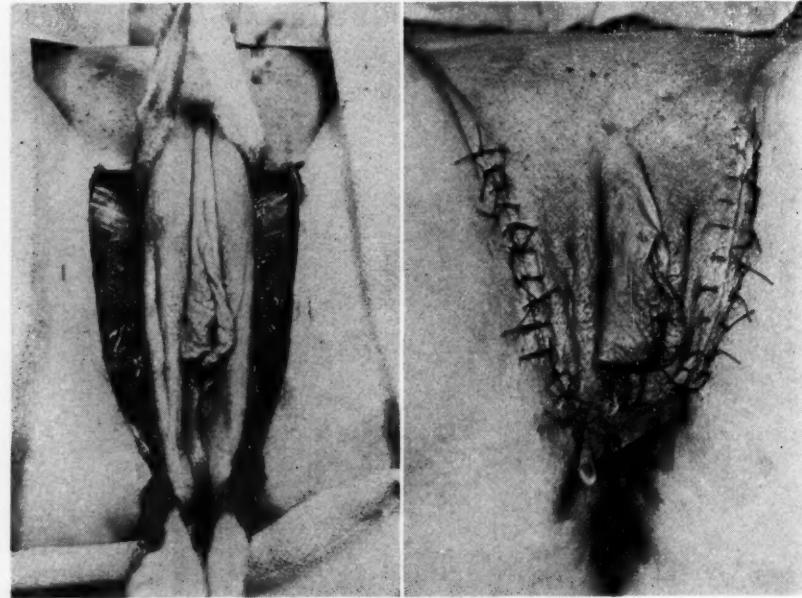


Fig. 7.

Fig. 8.

Fig. 7.—Operation completed. Vulvar tissues and portion of vagina mobilized.  
Fig. 8.—Drains placed, skin repaired.

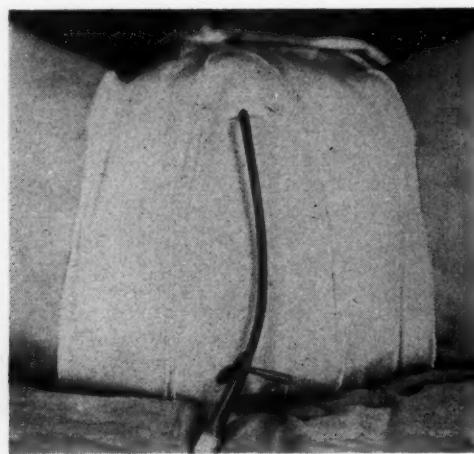


Fig. 9.—Elastoplast pressure dressing with 5 c.c. Foley catheter in bladder.

dressing is removed and patients are given an enema and cathartic on the fifth day, put back on solid food and permitted out of bed. The sutures and drains are removed on the sixth postoperative day and hot sitz baths daily for 15 min-

utes are instituted. Penicillin therapy is discontinued after 10 days. Washing the area with soap or other detergents is strictly forbidden and during convalescence patients are mentally conditioned to avoid touching the area with their hands. They are then discharged to home treatment which consists of sitz baths once or twice daily and sedation at night only if needed. They are not permitted to wear any clothes which may rub the area and are encouraged to use Tampax during the periods if in the menstrual age group. They are routinely checked at 6 weeks and every 2 months thereafter for a year. After the first year, they are requested to report to the clinic each 6 months. The patients are kept in bed for 5 days because of difficulty in walking with the pressure dressing in place, but are encouraged to sit up and move at will. The circulation to both lower extremities should be watched; pressure on femoral circulation can easily be allayed by small transverse cuts in the elastic adhesive.

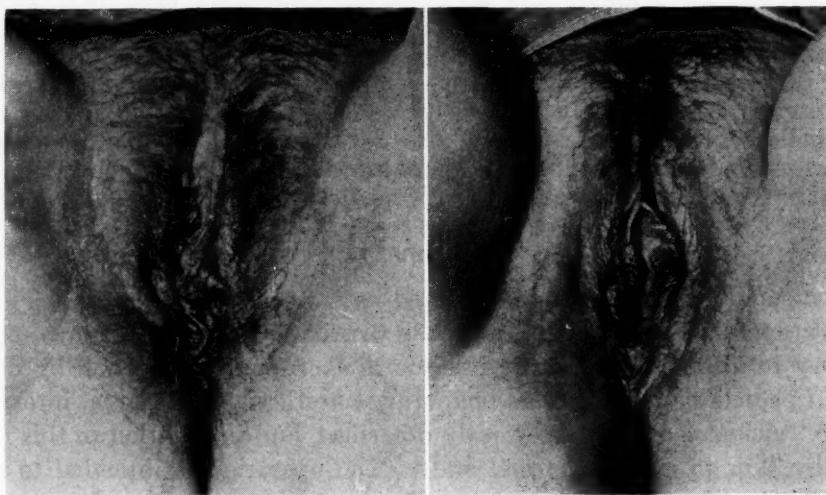


Fig. 10.

Fig. 10.—Case 10, postoperative appearance at 6 weeks.

Fig. 11.

Fig. 11.—Case 11, postoperative appearance at 10 weeks.

### Results

There seems to be an immediate loss of the desire to scratch and the primary healing of the wound is rapid and complete by the time the sutures are removed on the sixth day. So far there has not been a single instance of self-inflicted trauma after operation. In no case has there been further ulceration or excoriation of any part of the undermined skin. The first 3 patients were seen at intervals for 2 years and have not reported since. There was no recurrence of skin pruritus or discomfort. All of the remaining group of 9 cases have been followed from 3 months to 3½ years and none has complained of a return of symptoms or a desire to scratch. They are all extremely grateful for the relief obtained, particularly the ability to rest at night, with subsequent loss of nervous tension and irritability resulting in a new outlook for the future. The mental and physical improvement was a striking factor in this small group. Sensory sensation has been interrupted only temporarily. In most cases there was still some numbness on testing with a sharp-pointed instrument after 14 days, but none had any loss of sensation after 6 weeks.

One other surgeon (E. J. B.) of the University Gynecological staff, performed this operation on 4 occasions within the last two years, using the same

criteria for the selection of his cases. He did not use the recommended pressure dressing for 5 days postoperatively. There were unqualifiedly excellent results in 3 cases without recurrence of symptoms to date. The fourth case was a complete failure on which he felt it necessary later to perform a radical vulvectomy. It is suggested by him that failure to splint the area properly by pressure may have been a large factor in the failure to obtain a good result in this particular instance.

The final tabulation as of this date leaves a total of 15 of 16 cases without recurrence of pruritus, or 93.75 per cent.

### Complications

Before the elastoplast pressure dressing was devised, and drainage instituted, there was one large hematoma beneath the incision which necessitated evacuation and prolonged the hospital stay to 21 days. One small hematoma was noted which needed no specific treatment, did not prolong hospitalization, and eventually absorbed completely. One patient developed an annoying cystitis which needed further treatment, but cleared completely on a regime of forced fluids and Gantrisin, 2 grams daily for 10 days. Postoperative morbidity was confined to a febrile reaction in the patient who developed cystitis. In all others, the temperature fell to normal within 48 hours and remained below 99.4° F. for the remainder of their hospital stay. No medical complications were noted.

### Summary

This small group of 16 cases is used as material for a preliminary report of a new operation to relieve intractable pruritus vulvae of unknown etiology. In theory it utilizes the plastic principle of increasing circulation by delaying skin and pedicle flaps; it creates temporary anesthesia of the area, interrupting first the "vicious cycle" as previously described, and in addition to this restores unhealthy skin to a more normal state. The operation is intended to replace the mutilation of partial or complete vulvectomy in the absence of premalignant or malignant changes. It rarely needs to be employed and should be used only as a desperation measure when other logical procedures have failed. The indications for its use should be carefully surveyed. The excellent results in this small group encourage this report in the hope it may be more widely accepted and performed with the objective of securing more detailed statistical data.

### Conclusions

1. Wide plastic undermining of the skin of the vulva, thigh, perineum, and mucous membrane of the vagina offers promise to replace vulvectomy when there is intractable pruritus vulvae of unknown etiology.
2. The majority of cases are postmenopausal and may be related to atrophy and decreased volume of circulation of the skin in this area after cessation of hormonal influence.
3. The surgical phase is not difficult and has not been attended by severe complications of any nature during or after the operation.
4. Results in 16 cases to date have been very excellent. There was one failure, but otherwise no reported recurrences of sensory skin sensations, ulceration, or excoriation. The general mental and physical state of these 16 patients has been greatly improved.

5. This operation should be considered only when more conservative measures have consistently failed to alleviate or correct constant continuous pruritus vulvae.

6. Fifteen of sixteen patients have had an excellent result to date, some as long as five years at this writing. The 93.75 per cent of ostensible cures in such a small series may be misleading. This figure can be corroborated or disproved only by wider acceptance and practice of the technique among gynecologists, with published statistical surveys.

The author wishes to thank the following for their cooperation: the resident staff of the Elizabeth Steel Magee Hospital; Dr. E. J. Bateman of the Gynecological Staff; and Dr. S. M. Dupertuis, Chief of the Department of Plastic Surgery, University of Pittsburgh, School of Medicine.

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### Discussion

DR. S. M. DUPERTUIS.—Employing a sound surgical procedure, well recognized in plastic and reconstructive surgery, Dr. Mering has presented a series of excellent results for the difficult problem of intractable pruritus vulvae. Undoubtedly, complete denervation of the skin, with relief from the trauma of continual scratching, plays an important and perhaps major role in the relief of this condition. The disappearance of pigmentation and the return of normal skin texture and color, however, present the possibility of an actual increased vascularity for a period of time following wide undermining of the tissues. From our experience in reconstructive surgery, three clinical observations support this hypothesis. In a case of unilateral facial atrophy with definite pigmentation of the skin, the wide undermining necessary to permit the insertion of a large dermal-fat graft caused the pigmentation to disappear, and the skin to resume its normal texture and color. A second observation has shown in several instances an actual increased growth of hair on a pedicle flap transplanted from one thigh to the opposite leg. Again, we have observed several cases of nonunion of the tibia of twelve to eighteen months' duration develop spontaneous union without bone graft after replacement of the overlying surface scar by a pedicle flap from the opposite leg. The three instances cited represent varying applications of the old principle of delay by undermining, first described by Tagliacozzi in 1597, and suggest later increased blood supply of the undermined or transplanted tissue.

Several recent experimental studies of the blood supply in tubed pedicles and flaps further support this thesis. In tubed pedicles and flaps x-ray studies and injection methods demonstrate a marked increase in the size of the subdermal vascular plexuses. It is postulated that the enlarged subdermal vascular bed, with its reduced resistance, permits the remaining peripheral blood supply to circulate more freely. Thus, after wide undermining, while an actual vascular deficit exists, adequate nourishment of the tissues is maintained. As a new collateral circulation returns quickly through the healing tissues, the initial vascular debt is eliminated, and, if the subdermal plexuses remain dilated, it is probable that increased vascularity actually exists for a period of time. Kynes in England and Conway in this country explain this mechanism in demonstrating that the undermined tissues have been sympathectomized by section of most of the vessels. These areas show reduced or no sweating as observed in the iodine starch test. Braithwaite of England on the other hand, supports Sir Thomas Lewis' contention that the dilatation of the subdermal plexuses is caused by the metabolic products of the tissues during the period of decreased vascularity. Despite different views concerning the actual mechanism, recent experimental data and certain clinical observations indicate the probability of an actual increased vascularity for a period of time after the initial circulatory deficit has been restored.

## SPERMICIDAL BACTERIA IN THE CERVIX AS A CAUSE OF STERILITY\*†

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THE investigation of the sterile couple frequently discloses a situation in which the results of the postcoital test at the calculated ovulation date are very poor in spite of the fact that the husband has a normal sperm count and the wife has no obvious cervical abnormality or infection.

In searching for a cause for this apparent deterrent to fertility, numerous cultures of the cervical mucus were taken to find out if there were bacterial organisms present in the cervix which might be spermicidal and thus prevent normal sperm viability and migration. In a previous communication Matthews and Buxton‡ reported on the findings of these cultures and observed that certain bacteria, notably *Escherichia coli*, *Streptococcus viridans*, and *Streptococcus hemolyticus*, proved to be highly spermicidal when placed in sperm suspensions in vitro. Other less commonly found organisms such as *Clostridium welchii* and *Proteus vulgaris* were also found to be spermicidal whereas *Bacillus subtilis*, hemolytic and nonhemolytic staphylococci and diphtheroids did not prove deleterious to sperm motility in vitro. Furthermore, the addition of specific antibiotics to the sperm-bacteria mixtures in vitro resulted in prolongation of the life of the spermatozoa.

These facts suggested the use of antibiotics clinically when spermicidal organisms were found in the cervix and the poscoital test showed no sperm, other factors being normal. In order to test this theory, the following clinical investigation was carried out.

### Material

This study included a total of 209 clinic and private patients on whom routine sterility investigations had been completed and on whom 547 cultures of the cervix were made. Couples with major causes of sterility, namely, closed tubes, azoospermia, etc., were excluded from this series but those with minor abnormalities were included.

No patients in this group showed any evidence of gross cervical infection. Postcoital tests and cervical cultures were taken at the time of ovulation as determined by basal body temperature records. The quantity, pH, and other characteristics of the cervical mucus were noted, as well as the number, motil-

\*This investigation was supported by a grant from the Lederle Laboratories Division of the American Cyanamid Company through the courtesy of Dr. Benjamin Carey. They also supplied aureomycin. The other antibiotics were supplied by Merck and Co., and Charles Pfizer and Company.

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‡Matthews, C. S., and Buxton, C. L.: Fertil. & Steril. 2: 45, 1951.

ity, and general morphology of the sperm. Organisms obtained from the culture were tested *in vitro* for spermicidal activity and sensitivity to various antibiotics. When spermicidal organisms in the cervix were found, specific antibiotics were given in the preovulatory period so as to provide a favorable environment for sperm migration. Postcoital tests and cultures were repeated after therapy and compared with initial tests.

One hundred seventy-six or 84.2 per cent of the 209 sterility patients tested had cervical cultures which grew out of one spermicidal organism or another, or, in occasional cases, out of more than one.

Ninety-five of these 176 patients were treated by the above-mentioned methods, the others not having been treated for various reasons.

### Technique of Treatment

The spermicidal organism, or organisms, having been identified in each patient, an antibiotic having the best bacteriostatic effect on that organism was administered to the patient. The appropriate antibiotic was determined by the usual sensitivity tests *in vitro*. Several different antibiotics were used. Aureomycin or terramycin was given orally in doses of 2 Gm. daily for 4 days immediately following a menstrual period. With penicillin, streptomycin, and bacitracin the intracervical route was employed. A course of treatment consisted of 4 injections of one of the following drugs: penicillin—1 million units, streptomycin—0.5 Gm., and bacitracin—2,000 units per injection given every other day in the preovulatory phase of the menstrual cycle. These antibiotics were dissolved in 2 c.c. of saline or distilled water and injected into the submucosa of the cervical canal at 4 or more points. Injection of India ink in a similar manner in extirpated uteri showed most of the dye in vascular or lymphatic channels. From this it is evident that eventual absorption of the drug via the blood stream can be expected after it has been in close contact with infected cervical glands and submucosa. After treatment, cervical cultures and postcoital tests were repeated at ovulation time and if spermicidal organisms were still present treatment with the same or other antibiotics was given again after the next menstrual period.

*Changes in Cervical Culture After Treatment.*—The purpose of treatment was to produce an environment in the cervical mucus as favorable to sperm as possible at the time of ovulation. Of 95 patients treated with antibiotics 49 (51.5 per cent) had posttreatment cultures which were free of spermicidal organisms after 1 or 2 courses of therapy. An additional 38 patients, after one course of treatment, had cultures which no longer grew the particular organism for which they were treated, but disclosed other spermicidal organisms which had to be treated with another antibiotic. This phenomenon is important because successful riddance of one spermicidal organism does not necessarily render a permanent cure. Subsequent reinfection with other spermicidal organisms obviously may still offer a barrier to fertility. Moreover, when two spermicidal organisms are present and one antibiotic is given, the organism less sensitive to that particular antibiotic may build up so much resistance as to necessitate the use of other antibiotics later. There were very few instances in which antibiotics completely failed to eradicate a particular spermicidal organism. In only 8 out of 95 treated patients did persistence of the same spermicidal organism occur after one course of therapy while in two others a positive culture was obtained after two courses. The possibility of reinfection from a constant source, e.g., intestinal tract, genitourinary system, or contamination from the husband has to be kept in mind.

These data are graphically represented in Table I which also shows an interesting correlation between change in cultures and change in postcoital tests.

TABLE I. CERVICAL BACTERIOLOGY: CORRELATION BETWEEN CHANGES IN CULTURE AFTER TREATMENT, RESULTS OF POSTCOITAL TESTS, AND INCIDENCE OF PREGNANCY

CHANGES IN CERVICAL CULTURE AFTER TREATMENT		RESULTS IN POSTCOITAL TESTS		PREGNANCIES
Persistence of growth of same organisms	8	No change	34	0
Occurrence of other spermicidal organisms	38	Improved	5	1
	46	Excellent	7	4
Disappearance of spermicidal organisms	49	No change	4	0
		Improved	15	1
		Excellent	30	15
Total	95			21

*Changes in Postcoital Tests After Treatment.*—Postcoital tests were done as often as possible at the time of ovulation. Mucus was removed with a Knight nasal polyp forceps from both the higher and lower portions of the cervix and its physical characteristics as well as the sperm population were examined as previously described. A differential count was also made so that the percentage of abnormal forms could be compared with that in the semen.

Each case was considered separately on its own merits and evaluation of success in treatment was based on comparison of postcoital tests done before and after therapy. In favorable cases the character of cervical mucus greatly improved and the number of actively motile sperm was increased from a few to 500 to 600 per high-power field. The percentage of normal forms in the mucus usually exceeded that in the semen. Sperm motility was considered as important as the mere number of sperm present and could be demonstrated in frequent instances as long as 24 hours after coitus. Some instances were observed where active sperm were found in the cervical mucus 72 hours postcoitally.

Fifty-seven out of ninety-five patients showed definite improvement in the postcoital tests after 1 to 3 courses of antibiotic therapy. Most of these patients (40) improved after one course.

Thirty-eight cases had initially unsatisfactory postcoital tests which were not improved by therapy. Many of these patients had had extensive cervical cauterization resulting in partial stenosis of the cervix and destruction of most of the mucus-secreting cervical glands.

TABLE II. RESULTS OF POSTCOITAL TESTS FOLLOWING ANTIBIOTIC THERAPY

		PREGNANCIES	
Improved or excellent	Persistence of bacterial growth in cervix or occurrence of other spermicidal organisms	12	5
57	Disappearance of spermicidal organisms in cervix	45	16
No change	Persistence of bacterial growth in cervix or occurrence of other spermicidal organisms	34	0
38	Disappearance of spermicidal organisms in cervix	4	0
Total sterility cases treated		95	21

*Pregnancies.*—Twenty-one patients out of ninety-five treated cases became pregnant, an incidence of 22.1 per cent.

It is interesting to inspect the groups in which the pregnancies—or what might be called the successful results—occurred.

A reinspection of Table I discloses the great preponderance of pregnancies to be in that group of cases where the spermicidal organisms were eliminated, presumably by treatment, and also the postcoital test results became excellent. There were a few cases, however, where spermicidal organisms persisted but, in spite of their presence, the postcoital test results became excellent and some pregnancies developed. This will be commented on later.

A reinspection of Table II, however, reveals the fact that no pregnancies occurred in cases in which the postcoital test results did not improve. Parenthetically, this information has interesting implications in generally evaluating the diagnostic potentialities of the postcoital test, aside from its relationship to the present problem.

### Comment

For the most part these 95 couples were the residue found in every sterility clinic or practice in whom no radical abnormalities could be found or in whom previous therapy for supposed abnormalities was of no avail. The duration of sterility in these cases ranges from 1 to 12 years, with an average of 3½ years. The percentage of success is not high in a sterility clinic which has an over-all percentage of about 25 to 28 per cent success. These cases are, however, a selected group—being the remainder left after other investigations and treatments have failed, and in this sense the percentage of pregnancies may be of some significance.

Another possible reason why the percentage of success is not greater is that the type and technique of treatment may be improper and inadequate. Only 46 of the 95 cases, or 48 per cent, had spermicidal organisms eliminated from the cervix after treatment. This is an indication that the treatment might be greatly improved upon—a problem which is being worked on at the present time. The reinfection of the cervix with spermicidal organisms other than the ones originally found is apparently a significant factor and methods of preventing this must be searched for. It is hoped that if a much higher percentage of cases can be successfully treated with a subsequent increase in the number of good postcoital tests, the pregnancy percentage will be much greater.

Other aspects of this problem must also be more thoroughly investigated. It was stated previously for instance that 176 or 84.2 per cent of the 209 sterility patients tested had spermicidal organisms found in the cervix. One immediately wonders what percentage of normally fertile women might harbor such organisms. This would present a useful and significant control series but actually is a difficult one to obtain. A "normally fertile" woman might easily harbor spermicidal organisms in the cervix at certain times, during which she would be infertile, but not at others. Thus the sampling of control specimens would have such a pronounced chance time factor as to make the results of no significance unless repeated cultures were taken on each control, or unless the cultures were taken at the same ovulation time during which a patient conceived. Obtaining cultures of this latter type would demand, to say the least, great cooperation on the part of the controls. In spite of this, however, such a series has been started, and of the 9 patients of this type so far examined, none has harbored spermicidal organisms. This figure is as yet too small to be significant but is thought to be suggestive.

Another comparable figure of some possible interest in this study is the fate of the 81 patients of the 176 on whom cultures were taken and who had spermicidal organisms but who, for various reasons, were not treated. It was impossible to follow each member of this group because some of them disappeared, the results being obtainable on only 41. Five of these, or 12.2 per cent, had become pregnant, an incidence of about half that of the treated

group. However, this figure also may be of doubtful significance because so many of the group from which it was taken had disappeared, their disappearance being the obvious reason why they were not treated.

The quantitative aspects of both the bacterial and the sperm populations of the cervix may be of considerable significance in this problem but as yet this has not been studied. In those cases, for instance, where the spermicidal organisms remain in the cervix and good results of postcoital tests occur in spite of this, there is a possibility that there are sufficiently large numbers of sperm or sufficiently small numbers of bacteria, so that the former can overwhelm the latter and thus satisfactory results of the postcoital test are obtained. Certainly a large number of bacteria would have more devastating spermicidal activity than a small number, to say nothing of the fact that a large number of sperm would have more possibility of passing this bacterial barrier than a small number would.

There are these various aspects of this problem which need extensive further study. The results to date, however, especially concerning the relationship of the postcoital test to the presence of spermicidal bacteria in the cervix, and the concentration of pregnancies in the favorable group are thought to be of some significance.

### Summary

1. Cervical cultures from many sterile patients revealed the presence of organisms which possess the property of agglutinating and immobilizing spermatozoa in vitro. These organisms are the coliform bacilli, including *E. coli*, *E. coli* intermediate and *Aerobacter aerogenes*, hemolytic streptococci and *Streptococcus viridans* and a few strains of nonhemolytic streptococci, *P. vulgaris* and *Cl. welchii*.

2. Five hundred forty-seven cervical cultures taken at the time of ovulation from 209 sterile patients demonstrated the presence of one or more of these spermicidal organisms, in 84.2 per cent of patients.

3. All organisms obtained from cervical cultures were tested in vitro for sensitivity to antibiotics (penicillin, streptomycin, bacitracin, terramycin, and aureomycin) and the antibiotic to which the organism was most sensitive was used for treatment in patients in whom the presence of spermicidal organisms was the possible cause of sterility. Penicillin, streptomycin and bacitracin were injected intracervically and terramycin and aureomycin were given orally, in the preovulatory phase of the menstrual cycle. Postcoital tests and cultures were repeated and results compared with those of previous tests and cultures.

4. Of ninety-five treated patients forty-nine showed disappearance of spermicidal organisms after treatment. Thirty-eight showed similar results after therapy, but subsequently acquired a new infection by other spermicidal organisms and had to be treated with other antibiotics. Only 8 patients showed persistence of the same type of spermicidal organism after 1 or 2 courses of antibiotics. Improvement of the postcoital test results was observed in 57 treated cases.

5. Of the 49 treated patients who showed a disappearance of spermicidal organisms after therapy, there were 45 improved or excellent results of postcoital tests and 16 pregnancies.

Of the 46 treated patients who showed a persistence of growth of the same organisms or occurrence of other spermicidal organisms there were 12 improved or excellent results of postcoital tests and 5 pregnancies.

6. The postcoital test is an excellent indication of a patient's pregnancy potential, there having been no pregnancies in this series except in cases where the postcoital test showed improved or excellent results.

7. Of 95 patients whose cervices were carriers of spermicidal organisms and who were treated for this abnormality, 21 (or 22.1 per cent) became pregnant.

Of 81 similarly investigated sterility patients who harbored spermicidal organisms and were untreated it was possible to follow only 41. Five (or 12.2 per cent) of these latter patients became pregnant even though not treated, a pregnancy incidence of about half that of the treated group.

8. It must be emphasized that all these patients, both treated and controls, were the residue left in the Sterility Clinic and in the private practice of one of us (C. L. B.) after all other investigation and treatment had failed. In this sense they are a selected group.

We wish to express our appreciation for the assistance of Mrs. Betty Stevick and also of Miss Balbina Johnson of the Department of Surgery of the Columbia College of Physicians and Surgeons.

### Discussion

DR. JOHN MACLEOD.—While I am primarily a fundamental physiologist, I am tremendously interested in the female angle of infertility. I do believe that the cervical canal ultimately will prove to be probably the most important seat of infertility in the woman, in spite of closed tubes and all of the other factors. Nevertheless I am not completely convinced that what Dr. Buxton has presented tonight is the answer to the problem. I say that for several reasons: first, because of my intrinsic belief in the spermatozoa themselves as tremendously viable organisms. I am not being facetious in saying that. I say so because I have had all the opportunity in the world to test the spermatozoa against their own environment, and against changes in their environment. We must prove conclusively that these bacilli, these bacteria, do actually produce substances which have a tremendously inhibiting effect on the motility of the spermatozoa. I think we will show that the motility of the spermatozoa is primarily the fundamental factor in fertility. It is not count *per se*, with all due respect to Dr. Moench and morphology; it is the motility, it is the viability of the sperm.

Dr. Buxton is quite right, I believe, in the pursuit of this problem. I say I am not convinced of the present evidence merely because I am in full sympathy with the whole idea of this. I am not convinced because we do not yet—and I think Dr. Buxton would agree—have convincing evidence that bacteria or any of these agents in the cervical mucus are still the primary agent responsible for failure of motility.

What I would like to see would be a series, say around 500, 600, 1,000—perhaps I am being statistically conscious now—of women who have not been exposed to pregnancy, tested for what might be found at random in the cervical mucus.

I am afraid I am not in a position at the moment to analyze Dr. Buxton's statistics.

I believe that Dr. Buxton has absolutely the right idea, that it is something in the cervical mucus that may very well be the answer in about 60 to 70 per cent of the cases of female infertility. What is the problem in the cervical mucus? I am not sure at the moment that Dr. Buxton has the answer, but I am sure he is well on the way to finding it.

DR. I. C. RUBIN.—Much has been said about the cervical canal as being the burial ground of countless numbers of spermatozoa. For many years I felt that the immunological

side of sterility had not been attacked and although Dr. Buxton is not an immunologist nor a bacteriologist, he has approached a new field of research. This can only lead to clarifying the dark spots in that complex problem of sterility. Like many others, I have felt that in about 10 or 15 per cent of all our cases we cannot track down the causative factor. In the cervical canal such lesions as stenosis, atresia, synechia, or stricture, not only mechanical barriers but also biochemical in nature, are responsible for perhaps a large part of the obscure or "occult" percentage of sterility cases. It would be difficult, as Dr. MacLeod has remarked, to analyze and go into all the questions and figures that Dr. Buxton has raised.

One thing has impressed me very clearly: there is, at least, a well-organized problem. Dr. Buxton started out with an idea but did not force it. He made an excellent effort to identify the bacteria that were resident in the cervical canal. He cultured them. He made suspensions of them. He exposed spermatozoa to the suspensions containing cultured bacteria, originally found in the cervical canal of a particular patient, compared the loss of motility within a certain limit of time during which he allowed the bacteria to act upon the spermatozoa, and then he did something to combat the spermicidal action of the bacteria.

In this connection it is interesting to recall that Huhner, who focused most of his attention upon the postcoital test, thought that the presence in the vagina and cervix of only a few spermatozoa alive or dead exonerated the male, and we know this to be not quite an adequate statement. He felt that the cervical canal was also the first barrier which was lethal to the spermatozoa. However, in his experience, the gonococcus, which acts so pathogenically upon the genital organs of the man and woman, should by all rights have destroyed spermatozoa, but did not do so. In his time we saw a good deal of gonorrhea of the cervix, much more than we see now. He found many pregnancies, nevertheless, despite the presence of gonococcus at the time of impregnation. Whether the gonococcus may be or is a nonspermicidal organism remains to be seen, but in general I was deeply impressed with the figures bearing on the success which Dr. Buxton has reported in his sterility cases as against those where no treatment was given.

G. L. MOENCH.—Some years ago I presented to this Society a short paper on the bacteriology of the cervix based on the experiences of the veterinarians.

I should like to ask Dr. Buxton, first of all, what means were taken to determine the degree of the infection present in the cervix; that is, how many bacteria could be plated? The consensus of opinion of the Society at the time of my presentation was that the bacterial flora of the cervix which did not lead to morphologic changes was not significant. Since this was my view also I did not pursue my investigation further. Perhaps I should have done so.

Another point: I have tested the reaction of the sperm against coli serum, against coli and other bacteria in suspension, and against various purulent exudates. Generally the sperms kept merrily on their way. They are very resistant to insults. I believe the action of the cervical secretions on the spermatozoa is mainly a mechanical one and not of a chemical nature.

I fully agree with Dr. MacLeod that the degree of motility, not the percentage of motile forms, is the factor of prime importance. This I have emphasized for many years. For this reason I have also been against the Huhner test as a reliable test and indicator of the fertilizing qualities of the semen. When one examines the cervical mucus post coitum one will always, except in the case of complete absence of spermatozoa, find a greater or lesser number of sperms but these may well be the defective cells which have not been able to penetrate further, whereas the sperms which actually produce fertilization of the ovum have long since proceeded on their way, nor have they remained long enough in the cervix for any hostile secretions to have affected them.

Dr. Buxton noted that it took quite a long time before serious reduction of motility occurred. If it takes a correspondingly long time *in vivo* as *in vitro* very little, if any, harm should come to the sperm cells.

Again all of us who have worked in an active gynecological clinic know that some of the patients with the worst looking cervices become pregnant and have one child after another. Thus, I cannot but feel that there is something more than the flora of the cervix which leads to infertility. I feel, like everyone here, that the cervix may be a most important barrier to conception but I am not willing, at this time, to state the exact mechanism involved.

The figures which Dr. Buxton presented cannot be analyzed offhand and I would like to see a proper mathematical analysis made of the data presented here tonight. This might be enlightening.

**DR. WILLIAM H. CARY.**—In 1929, I wrote a paper analyzing more than 200 post-coital tests, at which time I concluded that the postcoital examination was the most important single test to appraise the fertility of a given marriage. If I understand this subject correctly, the success of cervical insemination has to do primarily with the question of viscosity. Normal spermatozoa will not invade a highly viscid secretion and lesser degrees of endocervicitis are inhibitory and often unrecognized.

It has been noticed that a man with a strong specimen will sometimes fertilize a woman with minor degrees of cervical involvement and a woman presenting an inviting cervical secretion may be ultimately impregnated by a male specimen of less than normal potentialities. These are the cases in which pregnancy may be long deferred. I do not know how to define briefly what constitutes a normal postcoital finding. A histologist must know the appearance of normal tissue before he can appraise pathological changes. Likewise, the gynecologist must familiarize himself with the macroscopic and microscopic appearance of normal cervical mucus, at the ovulatory phase, before he is able to evaluate the degree of impairment of cervical insemination.

I have no doubt that bacteria play an important part in this phenomenon but years ago I studied this matter by culture and smears and I must say to Dr. Buxton it was a very disappointing experience. We found various types of organisms in these secretions and I do not know how the predominant one is to be determined except in the rare cases when an old, latent gonorrhea is revealed. It is my opinion that invasion and persistent spermatozoal migration—not sluggish migration—must be established before fertilization is possible. It involves a principle of compatibility that is seen in other realms of nature.

If Dr. Buxton can establish a selective responsibility of certain bacteria it will prove an illuminating approach to this problem.

**DR. MORTIMER D. SPEISER.**—I would like to ask Dr. Buxton if he would clarify one point. Would you tell us what you consider a standard, satisfactory postcoital Huhner test?

**DR. J. N. NATHANSON.**—May I ask Dr. Buxton two questions? One, were any studies made of the bacteriology of the urethral and prostatic secretions of the man, especially in those cases in which failure of pregnancy followed? Two, would it be of value to treat the husband with the same antibiotics as the wife, in those cases in which there is a persistence of spermicidal action of the bacteria?

**DR. LOCKE MACKENZIE.**—I should also like to ask whether these spermicidal organisms have any effect on the pH of the cervical mucus?

**DR. WILLIAM T. KENNEDY.**—I have always felt that probably histamine is one of the substances that enters into spermicidal motility, that the motility of the sperm cell is considerably knocked out by histamine in the cervix. Has any study been done along this line?

**DR. BUXTON (Closing).**—It is true, Dr. Cary, that these patients, with very few exceptions, were the ones who had what would have been considered fairly normal cervical mucus. It was of the clear watery variety which is found in a normal cervix. It usually

was not evident that there was any infection. So, generally speaking, I think these patients could be considered as carriers of spermicidal bacteria in the same way as an individual is considered to be a carrier of organisms in his throat, etc.

I would like to be one of the first to agree with the idea that this is only one of the probably many aspects of cervical mucus which may produce sterility. There are obviously all kinds of chemical and physiological characteristics of cervical mucus which are inimical to sperm migration, and this is only one of them.

Dr. Moench asked an interesting question, which I wish could be answered, when he wondered if we knew how many bacteria were present in these cultures or in the cervix. I have no idea how many bacteria are present in these cervices and wish I knew some way of finding out how many there are. At the present time we have no idea.

We have made no studies at all as yet of possible contamination of the specimen by organisms in the male urethra or prostate. That certainly would be a worth-while project to consider for future investigation.

So far as gonorrhea is concerned, there have been no gonococci grown out in any of these cultures taken from the cervices but that of course does not mean that there were not gonococci there. It is very difficult to culture this organism. I suppose that probably it would be a good idea to try to use special cultures in such a way that we might be able to grow out gonococci.

The pH of the cervix was not changed significantly by the presence of these organisms. So far as histamine is concerned, we found that filtrates of these organisms did not kill the spermatozoa, so that apparently there was something in the bacteria themselves which produced this sperm immobility, rather than any possible toxin.

## INTERSTITIAL OCCLUSION OF THE FALLOPIAN TUBE: A CONSIDERATION OF ITS SURGICAL TREATMENT\*

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WHEN bilateral obstruction of the interstitial portion of the Fallopian tube is discovered in cases of infertility, the following questions present themselves: Will surgical correction of the obstruction effect fertility? Which additional therapeutic procedures are advantageous? Should the condition be considered a primary indication for surgery?

In 1936 Greenhill reviewed the literature, and the results of a questionnaire concerning operations on the Fallopian tube, and reported that surgical measures were of questionable value, chiefly because relatively few live births subsequently occurred. In 1947, D'Ingianni of New Orleans reported seventeen cases in which he attempted to relieve cornual occlusion by transplantation of the tubes, and the insertion of a temporary cannula. Three pregnancies resulted. Ingersoll reported five operations with pregnancies resulting in three cases. Rutherford and his co-workers reported six, with success in two.

### Material

The present report concerns 21 patients operated upon in the past four years for various pelvic disorders; 20 of them in addition had bilateral interstitial occlusion of the Fallopian tubes. Diagnosis was made either before or during the operation.

When the occlusion was discovered before laparotomy, preoperative examinations included: basal temperature readings, tubal insufflation studies followed by uterosalpingography, and Huhner tests. Studies were made to rule out pelvic infection, or any other local pelvic pathological condition contributing to infertility. Surgery was performed only when there was no evidence of active inflammation. The midecycle was chosen as the time for operation.

Prophylactic therapy in each case consisted of procaine penicillin, 800,000 units daily for two days before operation, and for four to five days postoperatively, or until morbidity subsided.

In each case, the affected portion of the tube was removed, and the remaining portion transplanted so that the epithelial lining was contiguous with the endometrium. When salpingostomies were performed, either the "cuff" or simple longitudinal splitting of the tube with eversion of the edges was employed. Following surgery, complete rest was insisted upon to favor healing with minimal inflammation. Investigation of subsequent patency was delayed for two or three months or until evidence of local inflammation had subsided, since healing may be delayed by any traumatizing procedure. Attempts to determine patency were first made by tubal insufflation, repeated when necessary. Patients in whom the insufflation test was negative were treated with diathermy and procaine penicillin. Those whose occlusion still persisted were further studied, whenever possible, with uterosalpingography.

\*Read before the regular meeting of the St. Louis Gynecological Society, Dec. 3, 1951.

TABLE I

NO.	CASE	AGE (YEARS)	ETIOLOGY	PATHOLOGY	RESULT OF RUBIN TEST PREOPERA- TIVELY
C. D.		40	Pelvic inflammatory disease	Fibromyoma of uterus. Third degree fixed retroversion. Bilateral cornual occlusion	---
1	J. V.	35	Tuboovarian abscess bilateral	Third degree fixed retroversion. Bilateral tuboovarian abscess, old. Right cornual occlusion. Fibrosis left tube	Closed
2	B. A.	25	Pelvic inflammatory disease	Bilateral hydrosalpinx. Corpus luteum cyst, left ovary	---
3	E. W.	30	Pelvic inflammatory disease following abortion	Multiple adhesions, fibromyomas. Third degree retroversion. Bilateral hydrosalpinx	Closed
4	J. Q.	26	Pelvic inflammatory disease	Bilateral hydrosalpinx	Closed
5	E. H.	35	Pelvic inflammatory disease	Third degree retroversion. Left surgical salpingectomy. Adhesions. Right cornual occlusion	Closed
6	J. H.	27	Endometriosis	Endometriosis. Both tubes closed at fimbriated end. Right cornual occlusion. Third degree retroversion	---
7	M. N.	33	Endometriosis	Endometriosis. Bilateral cornual occlusion. Third degree fixed retroversion	---
8	M. W.	35	Pelvic inflammatory disease	Right tube closed at fimbriated end. Cornual fibrosis of left tube. Fibromyoma	Closed
9	G. B.	24	Pelvic inflammatory disease	Bilateral tubal cornual occlusion. Left tube surgically absent	Closed
10	G. K.	30	Pelvic inflammatory disease	Bilateral tubal occlusion. Third degree retroversion, fixed. Adhesions	Closed
11	J. F.	24	Postpartum pelvic inflammatory disease	Third degree fixed retroversion. Adhesions. Left cornual occlusion. Right tube fibrotic	Closed
12	D. C.	40	Pelvic inflammatory disease	Fibromyoma. Bilateral occlusion of interstitial and fimbriated ends of tubes	---
13	H. D.	34	Unknown	Fibromyoma. Bilateral cervical laceration. Bilateral cornual occlusion	---
14	V. V.	29	Endometriosis	Endometriosis. Occlusion of left cornual and fimbriated end of cyst tube. Right tube fibrotic	Closed

TABLE

I

RESULTS OF UTERO- SALPINGO- GRAM PRE- OPERATIVELY	TYPE OF OPERATION	RESULTS OF RUBIN TEST POSTOPERA- TIVELY	POSTOPERA- TIVE X-RAY STUDY	PREGNANCIES
---	Myomectomy. Suspension of uterus. Bilateral excision of medial one-third of tubes with transplantation	Open	----	0
---	Suspension of uterus. Excision of one-third medial portion of tube and transplantation. Adhesiolysis. Left salpingo-oophorectomy. Appendectomy	Open	----	0
---	Bilateral salpingostomy and excision of medial one-third with transplantation. Left ovarian cystectomy. Appendectomy	Closed	----	0
Closed	Adhesiolysis. Myomectomy. Suspension of uterus. Bilateral excision medial one-third tube with transplantation. Bilateral salpingostomy	Closed	Closed	0
Closed	Bilateral salpingostomy. Bilateral excision of medial one-third with transplantation	Open	----	0
Previous opera- tive report available. Not done	Suspension. Persacral neurectomy. Adhesiolysis. Excision of medial one-third of right tube with transplantation	Open	----	0
---	Partial resection both ovaries. Bilateral salpingostomy. Right tubal transplant. Suspension	Open	----	2 (full term)
---	Partial resection of both ovaries. Left excision of medial one-third with transplant. Suspension. Adhesiolysis	Open	----	0
---	Right salpingostomy. Right tubal transplant. Myomectomy	Closed	----	0
---	Excision of medial one-third of right tube with transplantation	Open	----	0
---	Bilateral partial excision of medial one-third with transplantation. Adhesiolysis. Suspension	Closed	----	0
---	Adhesiolysis. Suspension. Left partial resection of medial one-third with transplant	----	----	1 (full term)
---	Myomectomy. Right salpingectomy. Left partial resection of medial one-third with transplant. Left salpingostomy	Closed	----	0
---	Myomectomy. Tracheloplasty. Bilateral resection of medial one-third with transplant	----	----	1 (full term)
---	Left oophorectomy. Left salpingostomy. Left partial resection of medial one-third with transplant	Open	----	2 (abortions)

TABLE I

NO.	CASE	AGE (YEARS)	ETIOLOGY	PATHOLOGY	RESULT OF RUBIN TEST PREOPERA- TIVELY
16	M. B.	28	Right ruptured ectopic pregnancy	Ruptured in isthmic portion of right tube	---
17	L. D.	26	Pelvic inflammatory disease	Bilateral hydrosalpinx. Adhesions	---
18	M. K.	29	Previous ectopic pregnancy with resection of isthmic portion, right. Postoperative pelvic inflammatory disease	Severed right tube. Atrophic and occluded left tube. Adhesions	Closed
19	R. M.	28	Pelvic inflammatory disease	Bilateral hydrosalpinx. Adhesions. Third degree fixed retroversion	---
20	B. E.	31	Endometriosis	Endometriosis. Left tube and ovary surgically absent. Right cornual occlusion. Chocolate cyst right ovary	Closed
21	G. J.	33	Unknown	Bilateral stenosis isthmic portion of both tubes. Third degree retroversion	---

The procedure described was selected for the following reasons: It is simple, can be performed in a short time, and requires no special instruments. The mesosalpinx is of sufficient length. The transplanted tube lies in a trough, in which, if scar retraction occurs, it will retract parallel to the axis of the tube rather than across it. This technique is based upon the assumption that a structure with a lumen tends to maintain the lumen in the absence of irritation by a foreign body or by infection.

The criterion selected as establishing a favorable outcome is patency of at least one tube, rather than subsequent pregnancy. The latter may not occur for some time, even when patency is secured, and infertility may persist from other causes.

### Results

Of 21 patients operated upon, 14 had unilateral resection of the interstitial portion of the tube with transplantation. In this group 10 were patent (71 per cent). The remaining 7 had the same procedure bilaterally, with 4 proving patent (57 per cent). In the first group (unilateral transplants) are included one partial resection and transplantation for tubal occlusion, performed as a primary indication, and one operation for a ruptured tubal pregnancy at the isthmus. This was resected along with the interstitial portion, and the distal two-thirds was transplanted into the uterine cavity. Both proved open by x-ray studies, although the fimbriated end apparently became closed in the second

TABLE I

—CONT'D

	RESULTS OF UTERO-SALPINGOGRAM PRE-OPERATIVELY	TYPE OF OPERATION	RESULTS OF RUBIN TEST POSTOPERATIVELY	POSTOPERATIVE X-RAY STUDY	PREGNANCIES
		Resection of medial one-third with transplantation	Not done	Both tubes open at cornual portion. Right fimbriated portion probably closed	
Closed		Adhesiolysis. Salpingostomy bilateral. Right tubal resection of medial one-third with transplantation	----	Left closed Right open	0
Closed		Resection of interstitial portion. Right tube with salpingostomy. Right tubal transplant. Adhesiolysis	Open	Right open	0
----		Left partial resection of medial one-third with transplant. Left salpingostomy. Right salpingectomy. Suspension. Adhesiolysis	Not completed	----	0
----		Right partial resection of medial one-third with transplant. Partial resection of right ovary	Closed	Closed	0
----		Bilateral resection of medial one-third with transplant. Suspension	Open	----	0

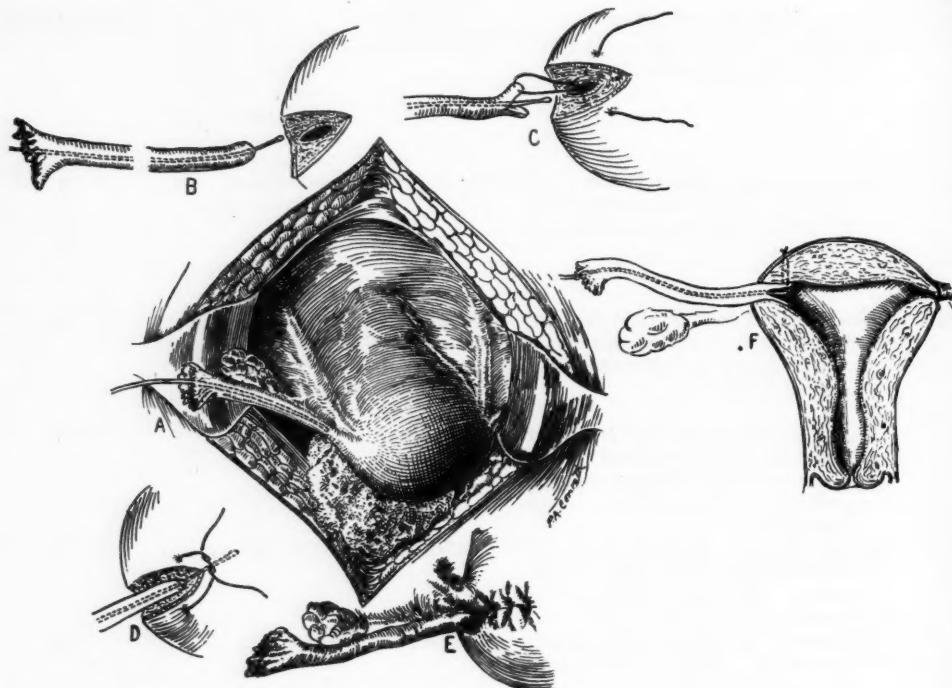
case. The combined percentage for the unilateral and bilateral transplantations for patency at the operative site was 66 per cent. Thus far 28 per cent (4 of the 14 patients) have become pregnant.

#### Comment

Pre- and postoperative use of antibiotics, and restraint in procedures to determine patency during the early healing period appear to us to be most important factors in obtaining the results cited. With selected cases of interstitial occlusion results might have been better. However, there is value in information which shows the results of tubal transplants in the presence of complications.

Whether the patients in the "successful group" will become pregnant remains a question. At this time 4 patients have become pregnant. Theoretically, where there has been previous damage to the ciliated epithelium of the tube by inflammation there may be some doubt as to the efficiency of the transportation of the ovum to the uterine cavity, and in those instances ectopic pregnancies might result. Likewise, where there has been no damage to the epithelium of the tube results should be better. In this group are included tubal pregnancies, endometriosis, sterilization operations, and that group of unexplained cornual occlusions.

The experience of others, and our own, is not sufficient to arrive at a definite conclusion regarding occlusion as a surgical indication. It would seem, however, that additional studies are warranted to determine whether surgery is justified in cases of interstitial obstruction of the Fallopian tubes.



**Fig. 1.—Description of operation:**

**A.** The abdomen is opened in the usual manner, all adhesions are freed. An abdominal gauze tape packing is placed in the cul-de-sac in sufficient quantity to support the uterus and appendages in easy reach for the operative procedure. This removes the necessity in most instances for the use of clamps and sutures for that purpose. The tubes are then explored. If the fimbriated end is closed a salpingostomy is performed first. Attempts are made to determine the passage of air through the intestinal portion of the tube by the use of a bulb syringe. If there is doubt as to the passage of air into the uterine cavity, the lumen of the tube is then explored with a small fistula probe. This is passed carefully to the point where obstruction is met. The tube is incised transversely over the probe just lateral to the occlusion.

**B.** The medial portion is excised by a wedge-shaped incision, which removes the interstitial portion of the tube and leaves a longitudinal incision in the uterine horn which extends into the uterine cavity. All bleeding points are ligated.

**C.** With the probe still in place the medial portion of the remaining tube is incised longitudinally across the top of the probe, forming a superior and inferior flap. This incision is usually about 1 cm. long. Double O chromicized intestinal suture on a small round needle is then passed through the uterine wall at the medial edge of the uterine incision and adjacent to its medial limits, passing into the uterine cavity. The suture is then carried to the tip of the superior tubal flap and a mattress suture is made at this point. The needle then passes into the uterine cavity through the incision and out through the uterine wall on the opposite side from the point of previous entry.

**D.** The tube containing the probe is then pushed into the uterine cavity and anchored by tying the suture. The probe is then withdrawn.

**E.** Closure is then made by approximation sutures; all are tied just tightly enough to control bleeding.

**F.** Artist's conception of the completed operation showing the probe in place if exploration is desired to make certain that the tubal lumen is continuous with the uterine cavity.

### Summary

1. Partial resection and transplantation were performed on 21 patients with interstitial occlusion, including one patient who was operated upon for ruptured tubal pregnancy.
2. Sixty-six per cent of these patients had at least one patent tube after operation.
3. Simplified surgical technique, preoperative and postoperative use of antibiotics, and postponement of tubal insufflation until healing is complete are considered to be important factors in attaining success.

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634 NORTH GRAND AVENUE

## AN ANALYSIS OF THE ADOLESCENT OBSTETRIC PATIENT

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PRENATAL care of the adolescent girl (16 years or younger), especially if unwed, is frequently either ideal, since she may be placed in a maternity home under the direct supervision of a trained obstetrician or is most meager, and she is unknowingly neglected until labor has begun. This neglect in prenatal care is the result of the failure of these adolescent patients to seek medical care, either because of ignorance, shame, or fear of reproach by their parents and/or physician. Harris<sup>2</sup> has stated that the ideal age, obstetrically, for a woman to have a first pregnancy is 16 years. To further substantiate this, Marchetti and Menaker<sup>4</sup> have recently reported an analysis of 634 patients who were 16 years old and younger, and found that these patients had an essentially normal prenatal course and delivery. Their patients had no more than the usual number of complications except for an increased incidence of toxemia (19.7 per cent). The recent widespread maternity health education of the public and the institution of free prenatal clinics and hospital care has tended toward an increase in the number of young indigent obstetric patients. Thus an analysis of those girls 16 years of age and younger who delivered at the Herman Kiefer Hospital in the three-year interval between Jan. 1, 1949, and Dec. 31, 1951, is presented.

### Material

During this three-year interval 9,941 patients were delivered and, of these, 481 were 17 years of age and 490 were 16 years of age and under. Like other teaching centers, referred pathologic cases increase the incidence of abnormal cases in the statistics, but it is believed that an analysis of these 490 adolescent patients, 16 years of age and younger, will yield a true indication of the effect of pregnancy and youth one upon the other.

Table I shows the distribution of these patients as to age and parity. Fifty-seven per cent of these patients were 16, 31 per cent were 15, and 10 per cent were 14 years of age. In the entire series 61, or 12 per cent, had had one previous pregnancy and 4, or 0.7 per cent, had had two previous deliveries. As might be expected, with increasing age there is increasing parity. Fourteen patients under the age of 16 years had more than one pregnancy but only one patient under 16 had two previous pregnancies. The incidence of patients 16 years and under in the general clinic population is 4.8 per cent, which is approximately that of Marchetti and Menaker<sup>4</sup> (6.3 per cent) and Von der Ahl<sup>3</sup> (5.4 per cent). As regards race it was noted that while the clinic ratio of white to Negro is 1 in 4, in this series of patients the ratio was approximately 1 in 8, (53 white to 437 Negro).

TABLE I. DISTRIBUTION OF 490 ADOLESCENT PATIENTS BY AGE AND PARITY

PARA	AGE						TOTAL
	12	13	14	15	16		
0	4	12	50	129	230		425
i	0	0	2	11	48		61
ii	0	0	0	1	3		4
Total	4	12	52	141	281		490

Of special interest were the 16 patients who were under 13 years of age for, though having only one pregnancy, they must have conceived almost simultaneously with the onset of ovulation. Table II indicates the onset of menarche and average age at delivery for this subgroup. One patient, aged 12, was noted as having had three menstrual periods prior to her amenorrhea; while a 13-year-old girl had only one menstrual period prior to conception.

TABLE II. AGE OF MENARCHE\* OF 16 PATIENTS 13 YEARS OF AGE AND YOUNGER

AGE	AGE AT MENARCHE				AVERAGE AGE AT MENARCHE	AVERAGE AGE AT DELIVERY
	10	11	12	13		
12		3			11	12 yr., 9 mo.
13	2	5	3	1	11 yr., 3 mo.	13 yr., 9 mo.
Total	2	8	3	1		

\*Two not recorded.

The reluctance of these patients to seek antepartum care is evident since only 246, or 51 per cent of the group, registered in the prenatal clinic and only 98 of these 246 patients were seen on five or more occasions.

Prenatal complications were moderate in number. A weight gain of over 25 pounds was seen in 22 per cent of the cases. Anemia of pregnancy was found in 28 per cent and, in addition, 2 cases of sickle-cell anemia were diagnosed. Venereal infection was not particularly common as only 18 patients had syphilis; however, there were 6 acute Neisserian infections. Rheumatic cardiovascular disease was diagnosed in 3 patients and 1 patient had congenital heart disease. The incidence of tuberculosis was 0.5 per cent.

The objective symptoms of toxemia were noted on one or more visits in 20 patients; in all but 3, however, response to conservative outpatient therapy was excellent. The majority of these patients had excessive weight gain and a slight elevation of blood pressure above normal and, since they responded to clinic management, hospitalization was not necessary.

The exact length of labor is difficult to determine as many of these patients are unable to date the onset of regular rhythmical uterine contractions. This is especially true of the nonregistered patient who has not received instructions as to the onset and mechanism of labor. The duration of labor was thus grouped into three divisions: under 3 hours, over 24 hours, and "normal." The so-called "normal duration of labor" (3 to 24 hours) is at variance with Busby's<sup>1</sup> conclusion that the mean duration of labor in a primigravida is 13.04 hours.

Twenty-three patients in this study had a labor under 3 hours; 40 patients had a duration of labor lasting more than 24 hours, while the remaining 427 patients were in the group of normal labors (Table III). The average length of labor for the group was 12.8 hours which compares favorably with Busby's<sup>1</sup> study.

Two factors may be offered as an explanation for the increased incidence of prolonged labor over that of the clinic's 1.5 per cent. Often the obstetrician's

opinion is influenced by the age of the patient so that additional time is allowed to elapse before an operative mode of delivery is chosen and watchful waiting becomes hopeful procrastination. Second, many of these young patients have had improper psychological preparation for pregnancy and are terrified of labor and delivery; this, according to Read's theory of fear, tension, and pain, may predispose to the so-called psychogenic type of uterine inertia and prolonged labor.

TABLE III. LENGTH OF LABOR IN 490 ADOLESCENT PATIENTS

	AGE					TOTAL
	12	13	14	15	16	
Under 3 hours	0	0	1	7	15	23
Over 24 hours	0	1	5	11	23	40
Normal	4	11	46	123	243	427

The type of delivery for the 477 vertex, 15 breech presentations and one conduplicato corpore is shown in Table IV.

TABLE IV. OPERATION AT DELIVERY IN 490 ADOLESCENT PATIENTS

Low forceps	266
Spontaneous	186
Breech extraction	15
Midforceps	9
Forceps rotation	13
Cesarean section	8
Conduplicato corpore	1
Manual rotation	26

Of the vertex presentations 266 were delivered with low forceps and 186 were delivered spontaneously. There was an increase in the number of forceps rotations (9) and midpelvic forceps deliveries (13); this was apparently a reflection of uterine inertia and prolonged labor. Eight cesarean sections were done, all for cephalopelvic disproportion. There were 15 breech extractions, 3 of the infants in these cases being twins, and this incidence is well within the established 3 per cent incidence for breech presentation.

Perineal lacerations and operations are tabulated in Table V, and with the exception of an increased incidence of episiotomy the statistics do not differ from those of the service as a whole. The three third degree lacerations occurred in cases in which inadequate episiotomies were made.

TABLE V. PERINEAL OPERATION OR LACERATION IN 490 ADOLESCENT PATIENTS

Unknown	1
Intact	59
Mediolateral episiotomy	388
Midline episiotomy	8
First degree laceration	22
Second degree laceration	12
Third degree laceration	3

Table VI indicates the weight of the infant by age in the series of 490 patients. Eighty-three, or 17 per cent, of these infants were premature and 49, or 10 per cent, were over 3,500 grams. The figure for prematurity is higher than the 13.5 per cent for the clinic and also higher than Marchetti and Menaker's<sup>4</sup> incidence of 12 per cent.

There were three sets of twins delivered by these women and this is less than the usual ratio of 1 in 88 deliveries. Of these six infants, three were under 2,000 grams, two were less than 2,500 grams and one was a term infant.

TABLE VI. WEIGHT OF INFANT IN 490 ADOLESCENT PATIENTS\*

	AGE					TOTAL
	12	13	14	15	16	
Under 2,500 grams	0	1	12	23	47	83
2,500 to 3,500 grams	3	10	38	99	202	352
Over 3,500 grams	0	1	1	18	29	49

\*Three sets of twins; weight in 9 infants not recorded.

The adolescent obstetric patient is difficult to manage either in or out of the hospital, for it is almost impossible to impress upon her the necessity of frequent prenatal visits, proper diet, rest, and adequate personal hygiene. An unusually high incidence of toxemia was expected but, as illustrated in Table VII, there was only one case of eclampsia and 41 cases of pre-eclampsia, of which 31 were classified as severe. This incidence of 8 per cent is higher than the clinic incidence of 4.1 per cent but lower than Marchetti and Menaker's\* 19.7 per cent. The lack of uniformity in diagnosis of pre-eclampsia in different institutions may account for this variance.

TABLE VII. TOXEMIA OF PREGNANCY IN 490 ADOLESCENT PATIENTS

	AGE					TOTAL
	12	13	14	15	16	
Mild	0	0	2	4	4	10
Severe	0	2	5	7	17	31
Eclampsia	0	0	0	0	1	1
Total						42

No placenta previa or severe abruptio placentae occurred among these adolescents. Of the 4 partial abruptio placentae cases, none required obstetric interference and there was no fetal mortality.

The second most common complication was cephalopelvic disproportion (Table VIII). Abnormalities of the pelvis might be expected in this age group for the pelvis may not be fully developed. A review of the actual pelvic measurements of these patients indicates that this diagnosis is made as often on the basis of fear by the obstetrician as to the age and general size of the patient as it is on the basis of pelvic measurement. The 8 cesarean sections were performed after a trial of labor and the major indication was cephalopelvic disproportion in all 8 instances. The section incidence for this group, 1.6 per cent, is almost identical with that of the clinic, 1.5 per cent.

TABLE VIII. MAJOR COMPLICATIONS OF PREGNANCY IN 490 ADOLESCENT PATIENTS

Toxemia	42
Infection	16
Cephalopelvic disproportion	20
Retained placenta	11
Stillborn	10
Postpartum hemorrhage	7
Abruptio placentae	4
Laceration of cervix	6
Tuberculosis (quiescent)	3

The progress of labor in all of these cephalopelvic disproportion patients was followed by vaginal examination and by repeated lateral x-ray progress films, which are advantageous during a trial of labor in cases of borderline disproportion. Progress films in labor afford an excellent method of determining descent of the presenting part, molding of the fetal head, and the prognosis of vaginal delivery. Excessive molding of the fetal head is best avoided and if it should occur cesarean section may be necessary on the basis of fetal indications. The fetal head may undergo extreme molding, but permanent brain damage may occur more often than is appreciated.

Sixteen, or 3.6 per cent, of these women had some type of postpartum infection: eleven had endometritis, four had pyelitis, and there was one case of pneumonitis. All of these infections responded to specific antibiotic therapy and were discharged well.

There were ten stillborn infants in this series (Table IX). Of this group four were macerated, four were under 2,000 grams, and the weights were not recorded in three cases. In this series the ratio of stillbirths per 1,000 live births is 20, and this compares favorably with the clinic ratio of 23.

TABLE IX. LIST OF STILLBIRTHS IN 490 ADOLESCENT PATIENTS

AGE	WEIGHT OF INFANT (GRAMS)	REMARKS
12	Unknown	Nonmacerated
16	2,727	Macerated
16	916	Conduplicato corpore
14	3,515	Nonmacerated
16	640	Macerated
15	2,869	Macerated
16	1,247	Nonmacerated
16	1,814	Nonmacerated
14	Unknown	Macerated
16	Unknown	Nonmacerated

In a recent review of stillbirths and neonatal deaths covering a three-year period, by Schoenvogel and Higginbotham,<sup>5</sup> there were only 2 stillbirths in women under the age of 16. Of great interest in the present study is the complete absence of fetal anomalies, either major or minor. In a review of major anomalies over a ten-year period in this clinic, which includes 20,000 deliveries, there were only three major anomalies in patients 16 years of age and under. There was one anencephalic monster in a patient aged 16, and 2 cases of congenital cardiac disease in the progeny from two 15-year-old primigravidas; both of these infants are still living. This would seem to indicate that not only from a maternal viewpoint is the age 16 ideal for the first pregnancy but there is a definite lowering of the incidence of stillbirths and major fetal anomalies.

The adolescent pregnant patient is often neglected prenatally because of the peculiarities of the socioeconomic status to which she is subjected, often denying her proper medical and psychogenic preparation for her pregnancy and delivery. In labor the caution and conservatism of the obstetrician, may, if extreme, actually become radical therapy. In the final analysis, the incidence of complications and difficult deliveries, with the exception of an increased incidence of prolonged labor and toxemia, among these adolescent patients is no different from that of any clinic which draws its patients from the same educational and nutritional stratum of life. Thus it is believed and urged that the adolescent pregnant female be treated without regard for her youth, and as though she were any ordinary pregnant patient. The one major exception to this might be, in view of her immaturity, that she needs especial reassurance and compassionate understanding on the part of her obstetrician and nurses.

### Summary

1. An analysis of 490 pregnant adolescent patients who were delivered on the Obstetric Service of the Herman Kiefer Hospital from Jan. 1, 1949, to Dec. 31, 1951, is presented (during this period a total of 9,941 deliveries occurred). There were no maternal deaths in this series and the morbidity rate was 3.6 per cent.

2. The patients of this age group differ only slightly from their "older sisters" as to complications during pregnancy, labor, delivery, and the puerperium. The major difference is an increased incidence of toxemia, increase in the incidence of prolonged labors, and an increased frequency of the prenatal diagnosis of cephalopelvic disproportion.

3. Operative interference due to cephalopelvic disproportion, in our hands, is not increased, however, and thus the inherent fear of difficult delivery per vagina is not substantiated.

4. The incidences of stillbirths and fetal anomalies are significantly lower than average in the adolescent obstetric patient.

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1512 ST. ANTOINE STREET

## **SUPERIOR HYPOGASTRIC SYMPATHECTOMY FOR THE RELIEF OF PAIN ASSOCIATED WITH ENDOMETRIOSIS**

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THE importance of superior hypogastric sympathectomy for the relief of primary and acquired dysmenorrhea has been emphasized recently in reports by Duncan,<sup>1</sup> Tucker,<sup>2</sup> Ingersoll and Meigs,<sup>3</sup> and Browne.<sup>4</sup> We have been interested in the use of this procedure primarily for the relief of pain associated with pelvic endometriosis and herewith we present our results in a series of 30 patients so treated at the St. Margaret Memorial Hospital during the years 1946 to 1951, inclusive. Follow-up studies were available on all, the postoperative period at the time of this writing ranging from six years to seven months. Our series, although small, comprises the largest number of cases we have found in the literature to date, in which the importance of presacral neurectomy as a part of the conservative surgical management of endometriosis is emphasized.

Elaut,<sup>5</sup> Labate,<sup>6</sup> and Weinstein<sup>7</sup> have described in detail the anatomy of the superior hypogastric plexus, and they have shown that in relatively few instances do the components of the plexus join to form a single nerve. More commonly, parallel nerves are found, and in 50 to 80 per cent of patients the superior hypogastric nerves take the form of a plexus. The recognition of such anatomical variations is essential if resection of the superior hypogastric plexus is to be complete.

### **Material**

From 1946 through 1951, 158 cases of pelvic endometriosis were treated. The diagnosis of endometriosis in this series was based on the pathologic findings where tissue was removed at operation, or on the gross appearance of sharply defined, puckered, "powder burn" or bluish purple endometrial nodules in those instances where material was not removed for pathologic examination. Of these 158 patients, conservative surgery was done in 87, radical surgery (loss of childbearing function) in 55, and radium therapy in four. Twelve patients were seen in consultation when an incidental diagnosis of endometriosis was made. They did not receive definitive surgical therapy. Presacral neurectomy, in addition to other conservative surgical measures, was done in 30 of 87 patients, and 57 patients received conservative surgical measures without sympathectomy.

The ages of the patients upon whom neurectomy was performed ranged from 18 to 33 years, with 18, or 62 per cent, falling within the 20 to 25 year age group. Eleven of the 19 married patients had never borne children, and the eight remaining patients had a total of only 11 pregnancies. All of the

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30 patients receiving presacral neurectomy had pain as the chief complaint. In 13, or 43.3 per cent, it was solely dysmenorrheic in type; in 5, pelvic pain other than dysmenorrhea was reported. Twelve patients complained of both dysmenorrhea and pelvic pain, so that in 25 patients (83.3 per cent) dysmenorrhea was contributory to the production of pain. Two patients complained of dyspareunia, and six had menstrual abnormalities.

Pain was the foremost criterion for superior hypogastric nerve resection. We agree with Counseller<sup>8</sup> that patients in whom painful lesions are confined to the uterus and sacrouterine ligaments will be most benefited by this procedure. However, since it is accomplished with little additional operating time and at slight risk to the patient, we suggest that presacral neurectomy is a useful procedure in all cases of pelvic endometriosis amenable to conservative surgery. Sympathectomy will not relieve pain associated with involvement of ovarian tissue, since afferent impulses from the ovaries are not mediated through the presacral plexus,<sup>6, 7</sup> but the procedure is assurance against the return of symptoms resulting from regrowth of endometriomas in, or progression of endometriosis to, the uterus, sacrouterine ligaments, broad ligaments, bladder peritoneum, and possibly the Fallopian tubes. We have not attempted neurectomy upon patients showing advanced endometriosis with vesical invasion, obstructive intestinal lesions, or ureteral impingement, since no conservative procedure sparing the ovaries seems justified in these patients.

### Procedure

Our technique for superior hypogastric sympathectomy is similar to that widely described. After exposing the triangular area in which the plexus lies, a midline, vertical incision is made through the posterior leaf of the parietal peritoneum, extending from just below the bifurcation of the abdominal aorta to approximately 3 cm. below the promontory of the sacrum. By blunt dissection the posterior surfaces of the parietal peritoneum are stripped laterally to the common iliac vessels, care being taken to avoid damage to the ureters. Accessory ureters and anomalies of the iliac vessels must be recognized at this time. The superior hypogastric nerve components are identified, and 1 to 2 cm. of the plexus are resected between clamps. The nerve ends are then ligated with fine silk and the peritoneum is closed with a running suture of fine plain catgut. If the middle sacral artery and vein are not damaged, hemostasis is no problem. Sympathetic nerves tend to regenerate,<sup>9</sup> but we feel that no regeneration will occur across the gap in nerve tissue created by our procedure. Additional insurance against regeneration may be found in the intraperitoneal fixation of the proximal nerve and as described by Wetherell.<sup>10</sup>

In our series there were 21 instances of endometrial nodules in the cul-de-sac; 10 instances of broad ligament endometriomas; and in 3 patients there was superficial involvement of the bladder peritoneum. Presacral neurectomy was not done as a sole procedure in any of our cases, but was combined with uterine suspension, dilatation and curettage, incidental appendectomy or combinations of these procedures. In addition, 7 ovarian resections were done, 2 for the removal of simple serous cystoma, 2 for the excision of follicular cysts, and 1 each for serous cystadenoma, lutein cyst, and endometrial cyst. Ovarian endometriomas were found and coagulated in 6 patients, but in only 1 was ovarian resection for endometriosis necessary. In 1 patient a vaginal plastic operation was done for the relief of a congenital stricture of the vaginal orifice, and in another a small hole was inadvertently opened into the bladder. The defect was immediately recognized and repaired without postoperative complications.

### Results

The results of follow-up examinations on the 30 patients treated by superior hypogastric sympathectomy, and of 44 of the 57 who received conservative surgery without sympathectomy, are analyzed in Table I. Twenty-nine (96.7 per cent) of the 30 patients were benefited by presacral neurectomy. Of those benefited, 24 of 30 (80 per cent) are completely pain-free since operation, and 5 (16.7 per cent) have had partial relief. There was only one failure (3.3 per cent) in the group.

TABLE I. POSTOPERATIVE PAIN RELIEF

	NO. OF CASES	COMPLETE		PARTIAL		NONE	
		NUMBER	PER CENT	NUMBER	PER CENT	NUMBER	PER CENT
Conservative surgery with presacral neurectomy	30	24	80	5	16.7	1	3.3
Conservative surgery—no presacral neurectomy	44	20	45.5	14	31.8	10	22.7

In the group of patients who were treated with conservative surgical measures without sympathectomy, 34 (77.3 per cent) were benefited by operation, but only 20 (45.5 per cent) were completely relieved of pain, and 14 (31.8 per cent) were partially relieved. Significantly, there were 10 failures (22.7 per cent) among the 44 patients. In other words, twice as many patients were completely relieved of pain when presacral neurectomy was added to the usual conservative surgical procedures. When sympathectomy was done, the operation resulted in only one complete failure, as against 10 failures when the neurectomy was omitted from the operation.

Our results, as compared to the results of others<sup>2, 3</sup> using presacral neurectomy in endometriosis, are summarized in Table II. The results in our group follow the trend set by Ingersoll and Meigs in their 10 cases. We have had more success with presacral neurectomy than Tucker. The explanation for this discrepancy may be that more ovarian endometriosis occurred in Tucker's group, and therefore complete relief of pain was less frequent following presacral neurectomy.

TABLE II. POSTOPERATIVE PAIN RELIEF AS COMPARED TO RESULTS IN OTHER SERIES

INVESTIGATOR	NO. OF CASES	COMPLETE		PARTIAL		NONE	
		NUMBER	PER CENT	NUMBER	PER CENT	NUMBER	PER CENT
Ingersoll and Meigs	10	9	90			1	10
Tucker	17	7	41.2	5	29.4	5	29.4
Dailey and Tafel	30	24	80	5	16.7	1	3.3

Superior hypogastric plexus resection results in few unpleasant after-effects. The procedure had no effect upon fertility in our patients, and we found that following presacral neurectomy, pain during the first stage of labor was lessened in almost every instance. Vaginal spotting beginning one or two days after operation occurred in a large percentage of our patients, and a few experienced menorrhagia with the first or first few postoperative menstrual periods.

Presacral neurectomy did not result in disturbance of normal bladder function in any of the 30 patients in our series, confirming the opinions of Kuntz<sup>11</sup> and White and Smithwick<sup>12</sup> that impulses conducted through the superior hypogastric plexus are not important for the maintenance of ordinary vesical sensations.

#### Comment

As previously stated, we did not confine our operation to the performance of presacral neurectomy, but we think neurectomy was responsible for the subsequent relief of pain. Uterine suspension was done in 17 of our cases, often as a prophylactic measure since retrodisplacement was present to a notable extent only three times. Perhaps suspension contributed to pain relief in these patients, but the benefit obtained in the other 14 is not thus explained.

The incidental removal of the appendix was not of primary importance in the relief of pain in the 17 patients upon whom appendectomy was done. Gross and histologic findings were "normal appendix" in 13 instances. None of the four remaining appendices showed any evidence of acute inflammation or mechanical obstruction. Inflammation of the nerve was not found in any of the presacral nerve sections, so that neuritis was not responsible for the production of pain in any of our patients.

We believe that interruption of afferent sympathetic fibers from the uterus is the mechanism of pain relief following superior hypogastric sympathectomy, although it has been suggested by some investigators<sup>13, 14</sup> that vasodilatation following sympathectomy is the important factor in relieving pain.

While it is true that sympathetic impulses to the uterus are vasoconstrictor in action and that uterine ischemia may result, we do not believe that vasodilatation following sympathectomy is of prime importance in the relief of pain. Blood vessels have an inherent ability to maintain tone even following sympathectomy,<sup>15</sup> and denervated vessels are still capable of sympathetico-adrenal response.<sup>16</sup> Furthermore, smooth-muscle receptors have been found to be hypersensitive to circulating adrenalin and adrenalin-like drugs following sympathetic-postganglionic fiber resection.<sup>17</sup> Therefore, vasodilatation is not complete even after sympathectomy and the reaction of patients to cold and emotional stress following this procedure should again produce vasoconstriction, uterine muscle ischemia, and recurrence of pain. We have found no such pain recurrence in our patients.

Presacral neurectomy should not be omitted in those cases in which gross endometrial implants are apparently destroyed by excision or fulguration, for there is no assurance that such destruction is complete. Furthermore, the possibility that presacral neurectomy may mask the symptoms of recurrent endometriosis is no contraindication to the procedure. Follow-up examinations will reveal objective signs of extension in the absence of subjective symptoms, and if the disease progresses to an extent of real concern, pain will not be masked because there will be involvement of viscera not innervated by the superior hypogastric plexus.

Since psychogenic disturbances may be responsible for pelvic pain, this factor was considered in the selection of patients for presacral neurectomy. In spite of careful screening, it is possible that psychoneurosis accounted for the failure to relieve pain completely in some of our patients.

#### Summary and Conclusions

Presacral neurectomy, in addition to the usual conservative surgical measures, was performed upon 30 patients having pelvic endometriosis. Of these,

24 (80 per cent) were completely relieved of pain, and 5 (16.6 per cent) were partially relieved. In only 1 patient (3.3 per cent) was neurectomy of no benefit in the relief of pain.

Conservative surgery without presacral neurectomy was performed upon 58 patients. Follow-up studies were available in 44, and of these 20 (45.5 per cent) were completely relieved of pain, and 14 (31.8 per cent) were partially relieved. Significantly, 10 patients (22.7 per cent) had no pain relief following operation.

Our results indicate that incidental appendectomy or uterine suspension did not play an important part in relieving pain in any of our patients.

No bladder impairment followed presacral neurectomy, in any of 30 patients. Fertility in the female patient is not disturbed by the procedure.

Superior hypogastric sympathectomy plays an important role in the relief of pain in cases of pelvic endometriosis with involvement of the uterus, sacro-uterine ligaments, broad ligaments, bladder peritoneum, and possibly the Fallopian tubes. It may be of benefit in all cases of pelvic endometriosis when conservative surgery is advisable.

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## **PERFORATED PEPTIC ULCER IN THE PUEPERIUM**

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**P**EPTIC ulcer is preponderantly a disease of men. This is particularly true of the duodenal ulcer. Various authorities cite the ratio of incidence of men to women as being somewhere between 4:1<sup>1</sup> and 5:1.<sup>2</sup> The incidence of perforation of peptic ulcer in the two sexes is also much greater in men varying from 25:1,<sup>3</sup> through 39:1<sup>4</sup> to as high as 74:0.<sup>5</sup> Furthermore, the general agreement among authorities as to the rarity of peptic ulcer during pregnancy is even more striking. In a survey of five Detroit hospitals over a ten-year period Sandweiss and associates (1943)<sup>6</sup> reviewed records of 70,310 pregnancies and discovered only one case of proved duodenal ulcer. Jones (1947),<sup>7</sup> in a review of 10,000 pregnancies at the prenatal clinic of the Central Middlesex Hospital, found not a single case of proved peptic ulcer.

The ameliorating effect of pregnancy on peptic ulcer instigated many investigations in an attempt to provide a logical explanation. Several theories were advanced. Hurst (1929)<sup>8</sup> suggested that the support offered the stomach by the rising uterus relieved strain thereby improving circulation and healing the ulcer. This explanation does not account for the relief that some ulcer patients obtain during the first trimester of pregnancy. Balint (1927)<sup>9</sup> found that while blood and tissue fluid tend to be acid in patients with peptic ulcer the pH rises to an alkaline level when pregnancy occurs. Investigation of gastric acidity at intervals during pregnancy revealed also a tendency for gastric acidity to rise during the last trimester of pregnancy and during the puerperium.<sup>10-14</sup>

Winklestein (1935)<sup>15</sup> as a result of Klein's<sup>16</sup> and Hollander's<sup>17</sup> work felt that the lactogenic hormone of the anterior pituitary gland was the cause of this marked increase in gastric acidity in the puerperium. He reasoned that the high concentrations of ovarian and placental hormones in the blood during pregnancy inhibit prolactin. With the fall in concentration of these hormones at delivery or immediately post partum, prolactin begins the stimulation of mammary secretions and coincidentally the increase in gastric acidity. He then treated dogs, in which he had chemically produced stomal ulcerations, with Theelin in oil. Complete healing of the ulcers took place in all animals in 10 days or less.

Other groups reporting on the treatment of peptic ulcer in human beings with various hormonal agents, namely, follicular hormones,<sup>18</sup> estradiol benzoate and propionate, testosterone propionate, Theelin,<sup>19</sup> anterior pituitary-like hormone,<sup>20, 21</sup> estrone,<sup>22, 23</sup> and corpus luteum<sup>24</sup> were unable to reach any definite conclusions. Opinions were almost evenly divided as to the efficacy of these hormonal agents in the treatment of ulcer both experimentally and

clinically. Bockus,<sup>25</sup> in summarizing the results of this work, concluded that proof favoring a direct relationship between pituitary function and the development of chronic peptic ulcer was lacking. There is sufficient evidence to suggest that hormones elaborated by the posterior lobe have some influence on gastric secretions and that a pituitary-gonadal imbalance may be in some way related to ulcer susceptibility and chronicity.

While the association of uncomplicated peptic ulcer with pregnancy is very unusual, complications resulting from such situations are even more uncommon. In a review of all available maternal mortality summaries up to 1943, Sandweiss and associates<sup>26</sup> found 13 cases of women who had died as a result of either hemorrhage or perforation complicating a peptic ulcer in pregnancy (confirmed by autopsy). Six additional cases had been reported but no autopsies had been performed. Of those with gastric ulcers 4 died from perforation and peritonitis and 3 died from hemorrhage. In those with duodenal ulcer death resulted in 5 cases from perforation and peritonitis and only 1 as a result of gastrointestinal hemorrhage. Of these 13 deaths only 3 occurred in the puerperium. Two were due to gastrointestinal hemorrhage, the other one resulted from perforation. In addition to the above complications resulting in death 7 operations for complications of peptic ulcer during pregnancy, with no mortality, were listed. There were no reports of operations during the puerperium for any complications of peptic ulcer.

Since the publication of Sandweiss' review 3 more cases, which either came to surgery or which terminated fatally have been reported. Anderson (1942)<sup>27</sup> cited the case of a 29-year-old white woman, gravida iii, para ii, who developed gastrointestinal symptoms several hours after a spontaneous full-term home delivery. She was treated conservatively for intestinal obstruction and peritonitis with decompression, transfusion, and oxygen but died 54 hours after admission to the hospital. Autopsy revealed a diffuse purulent peritonitis involving the whole peritoneal cavity and both subdiaphragmatic spaces causing the bowel to adhere in a conglomerate mass. A perforation 1.1 cm. in diameter was found on the anterior wall of the first portion of the duodenum. Clinically, it was interesting to note that while the patient's abdomen was markedly distended and tympanic at the time of her admission, there was only slight tenderness and no rebound tenderness or rigidity. Peristaltic sounds were absent.

James (1948)<sup>28</sup> reported the case of a 24-year-old primipara, with a known history of ulcer who, in the thirty-sixth week of pregnancy, developed the signs and symptoms of an acute abdominal disorder. Ten hours after the onset she was operated upon and a successful closure of a 4 mm. perforation on the anterior wall of the duodenum followed. The postoperative course was uneventful. On the fourth postoperative day, however, labor began and she delivered spontaneously a 6 pound living child after an easy labor. A test meal in the puerperium revealed marked hyperchlorhydria and a barium meal 6 weeks postoperatively showed that the ulcer was still active.

Baxter (1948)<sup>29</sup> added the case of a 29-year-old primipara who in the second month of pregnancy witnessed an accident to her sister and that night developed acute abdominal symptoms. Thirty-six hours later she was operated upon and a perforated prepyloric ulcer found and repaired. The patient's postoperative and subsequent gestational courses were uneventful.

This case report is submitted because of its rarity, being the first reported instance of perforation of a peptic ulcer in the puerperium with recovery, and because, like Anderson's case, it presented an atypical clinical picture. Actually, there have been reported previously only 4 cases of peptic ulcer with major complications during the postpartum period.

### Case Report

A 41-year-old white woman, gravida iii, para ii, was admitted to St. Anne's Hospital on Nov. 4, 1951. Prenatal examination on October 30 revealed a well-effaced cervix dilated 2 cm., with the vertex deeply engaged. She was 3 weeks past term and had a history of rapid labors. It was felt that a medical induction of labor was therefore indicated. She gave a history of intermittent vomiting for 3 days prior to admission. During the 10 years before this admission she had received treatment for attacks of mild epigastric pain accompanied by nausea and occasional vomiting. These attacks, 6 in number, were precipitated by some serious emotional crisis, and subsided completely after several days on a bland diet. She was entirely symptom free between these episodes. No gastrointestinal roentgenograms had been taken. Two previous pregnancies and puerperia, in 1941 and 1943, had been concluded without the occurrence of gastrointestinal symptoms. During the first trimester of this pregnancy slight nausea had been relieved by Dramamine.

The temperature was 97.8° F. and the pulse rate was 88 per minute. The estimated date of confinement was Oct. 3, 1951. Physical examination disclosed no unusual findings. The uterine fundus was at the costal margin and a live fetus presented by the vertex. There was no abdominal tenderness or rigidity. Despite the history of vomiting the patient was fairly well hydrated and no signs of toxemia were seen. The cervix was dilated 2 cm. There were no uterine contractions.

Induction was attempted with intramuscular pituitrin (1 min. every half hour for 6 doses) without success. She did no vomiting at this time and food was taken well. The following day her oral intake was supplemented with 1,000 c.c. of 5 per cent glucose in water and the patient had only a small amount of vomiting. On Nov. 6, 1951, induction with pituitrin was again attempted. At 9:30 A.M., concluding a two and one-half hour labor, a viable male infant was delivered under ethylene-oxygen anesthesia. That evening a general diet was taken well and there was only one instance of vomiting. On November 7, her first postpartum day, uterine contractions required relief with codeine and food was taken poorly. She vomited again that evening. At 7 P.M. she still complained of "afterpains" in the suprapubic area and noticed a slight cramp in the left shoulder. Physical examination revealed no signs of acute illness. The temperature and pulse rate were normal. There was an acetone odor to the breath and slight abdominal distention. There was no tenderness on direct palpation, no rebound tenderness and no rigidity over any part of the abdomen. Peristaltic sounds were hypoactive but definitely audible. Urine examination revealed 4 plus acetone. Intravenous fluids and morphine sulfate  $\frac{1}{6}$  gr. were given. At 12:45 A.M. on November 8 she still complained of severe uterine cramps but shoulder pain was no longer present. The abdomen was soft but slightly tender over the uterus, the left parametrium and the epigastrium. No rebound tenderness and no rigidity were present. Peristaltic sounds were still present and hypoactive. She was distended slightly. At 11:30 A.M. on November 8, the patient complained of severe abdominal pain and on examination soon after was found to have suffered circulatory collapse, with the blood pressure unobtainable and the pulse weak and thready. The abdomen was still soft. There was no rebound tenderness or rigidity, but tenderness on direct palpation over the entire abdomen was present. Peristaltic sounds were no longer audible and upward displacement of liver dullness was demonstrated. Intravenous fluids were started, Wangensteen drainage was instituted and a blood transfusion given. An oxygen tent was installed. The possibility of a perforated peptic ulcer was entertained even though there was complete absence of rigidity and rebound tenderness. A portable x-ray film of the abdomen confirmed the presence of air under the right leaf of the diaphragm. At 3 P.M., after 500 c.c. of whole blood had been given and 1,000 c.c. were being administered her blood pressure was 90/40 and she seemed better. She was taken to surgery and the abdomen opened under cyclopropane-oxygen anesthesia through a right upper paramedian incision. A large amount of free air and greenish fluid were present in the abdominal cavity. This fluid was aspirated. The serosal surfaces of the abdominal viscera were hyperemic and a perforation about 1.5 cm. in diameter was found on the anterior surface of the first portion of the duodenum. A moderate amount of fat necrosis of the omentum was also noted. A simple

closure of the perforation with 3 interrupted silk sutures and attachment of a piece of omentum over this area completed the operation. The abdomen was closed without drainage. The immediate postoperative condition was poor. Six hours later she appeared much improved, was conscious and alert. The temperature was 100.2° F., pulse rate 96, and blood pressure 106/75. The abdomen was soft and there was practically no pain. Convalescence was uncomplicated and she was discharged on November 21. She refused to have a gastric analysis performed during the postoperative period.

*Comment.*—While this patient presented many of the usual symptoms of a perforated peptic ulcer, several of the most common clinical signs were absent. At no time was there any abdominal rigidity or rebound tenderness and only slight tenderness on direct palpation was present. It may or may not be coincidental that Anderson made similar observations on his patient. Fortunately, the absence of these signs offered no obstacle to a definite diagnosis. It is difficult to know whether or not the absence of rigidity and tenderness was directly related to the atonicity of the postpartum abdominal musculature.

The perforation in this case, as in Anderson's, showed no indication of closing spontaneously. This would indicate that surgical intervention is the preferred treatment in the pregnant as well as the nonpregnant patient.

Finally, the effect of the pituitrin used in induction on the pituitary-gonadal relationship might have etiological significance. However, the initial complaints of nausea and vomiting preceded the introduction of this additional factor.

### Summary and Conclusions

1. It is evident from a review of the literature that there is no agreement among investigators as to how the apparently beneficial effect of pregnancy upon the activity of peptic ulcer is achieved.
2. Some evidence favors the influence of endocrine disturbances as a factor in ulcer susceptibility.
3. A case of perforation of duodenal ulcer during the puerperium, the first reported case with recovery, is described.
4. The diagnosis of perforation of a peptic ulcer must be considered in acute abdominal disorders in pregnant individuals even in the absence of a completely typical picture.
5. Neither pregnancy nor the postpartum state constitute any contraindication to the surgical treatment of a perforated peptic ulcer.

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4950 THOMAS STREET

## ENDOMETRIAL HYPERPLASIA AND CARCINOMA OF THE CERVIX\*

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A FEW years ago it was claimed<sup>1, 2</sup> and widely quoted that vitamin B deficiency rendered the liver incapable of inactivating estrogens. The consequent excess of estrogens acting over a long period of time caused carcinoma of the uterus.<sup>3</sup> It was further claimed that in 50 patients with carcinoma of the cervix there was evidence of excessive tissue estrogens in 92 per cent and thiamin deficiency in 86 per cent.<sup>4</sup> In 1949, Greene and Suckow discussed this subject.<sup>5</sup> In their opinion, if this hypothesis on the relationship between vitamin B deficiency, excessive estrogens, and carcinoma of the cervix were valid, one would find endometrial hyperplasia in patients with carcinoma of the cervix. They investigated the small amount of material available and quoted from the works of both Martzloff,<sup>6</sup> and Pund and Auerbach.<sup>7</sup> No evidence was found to support this thesis. In fact, a relatively low incidence of hyperplasia was noted. More recently, Bainborough has reopened the issue.<sup>8</sup> From his own material he concluded that "hyperestrinism" is a causal factor in carcinoma, in squamous metaplasia, and in "hyperkeratosis" of the cervix since these conditions are more commonly associated with hyperplastic than with normal endometrium. He did grant, however, that "some other factor, the nature of which is as yet unknown, is necessary for the development of carcinoma." He criticized Greene and Suckow for not having had a "control series" and also (probably with justification) for not stating their criteria for the microscopic diagnosis of hyperplasia of the endometrium. It is difficult to understand exactly what he meant by a "control series." Greene and Suckow were testing the validity of an hypothesis that excessive and prolonged estrogen stimulation may cause carcinoma of the cervix. If this were true, hyperplasia of the endometrium should be found frequently in association with this lesion. Hyperplasia of the endometrium was present infrequently; therefore, this hypothesis did not seem valid.

Bainborough gave his criteria for the diagnosis of hyperplasia. As far as the present authors can determine, these criteria were:

1. "Endometria in which multiple polyps resulting from a generalized exuberant growth of the endometrium as well as those exhibiting epithelial infolding of many of the glands as part of a generalized adenomatous hyperplasia."
2. A type of hyperplasia "left undescribed by Hertig and Sommers. It is considered a real hyperplasia though the swiss cheese appearance is lacking microscopically and there is no true adenomatous proliferation of glands

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extending through the endometrium. In this type the superficial glands are few in number and widely separated by a copious stroma. On the appearance of the superficial layer alone it could be considered stromal hyperplasia. Most of the endometrium is too thickened even for one in the secretory or premenstrual phase. On the slide after shrinkage from fixation and dehydration, it still measured 0.5 to 0.6 cms. in depth. In the basal glands which appear to react more readily to whatever stimulus produces hyperplasia, there is increased activity. Mitotic figures are scattered about in large numbers within both the stromal and glandular epithelium. The epithelial cells lining the glands are crowded and heaped up into several layers instead of being arranged in a pseudo stratified layer: the gland spaces while not cystic are larger than normal glands in the basal layer and are branching instead of tubular."

Two illustrations of these hyperplasias were included in the article. The first shows subnuclear vacuoles in the epithelium of every gland, but this is universally accepted as evidence of early secretory change in the endometrium and is hardly consistent with a diagnosis of hyperplasia. The second illustration was intended to show a branching gland in the basal endometrium. The gland depicted may be branching, but this appearance could well result from tangential section through a spiraling gland. Obviously, reconstruction from serial sections would be necessary to prove that this particular gland was actually "branching."

Bainborough had 26 specimens of carcinoma of the cervix in which endometrium was also available. He also studied the endometria associated with the cervices showing metaplasia and hyperkeratosis. Since the latter two conditions are not relevant to the subject they will not be considered further. As a control series, "well over 1000 uteri" were available. "Only those were used, however, in which sections from the cervix showed adequately the squamous epithelium of the vaginal aspect and the glandular mucosa lining of the cervical canal, while sections from the fundus showed a wide band of lining endometrium attached to the musculature, not distorted by curettement, antiseptic, fibroids, etc., within the uterus. All other cases excluded, 247 remained acceptable." He tabulated the findings in this control series; there were 170 uteri with hyperplasia and only 77 with normal endometrium! This means that 69 per cent of his control patients (who did not have carcinoma of the cervix) had hyperplasia of the endometrium (according to his criteria). In his 26 patients with carcinoma of the cervix, 13 showed hyperplasia. This makes 50 per cent of such patients. This obvious comparison between the patients with and those without carcinoma was omitted or overlooked by Bainborough!

Since the contribution by Greene and Suckow on this subject, much more material has become available in our laboratory. Stimulated by Bainborough's article, we decided to review the new material and determine the incidence of hyperplasia of the endometrium in patients with carcinoma of the cervix. The following does not include any of the data originally published by Greene and Suckow.

#### Materials and Methods

Seventy-seven specimens of carcinoma of the cervix with associated endometria were available for study. Microscopic study revealed that 51 of these 77 were preinvasive; 11 were minimally invasive, and 15 invasive. Carcinomatous epithelium which penetrates into a gland is not considered to be true invasion in this laboratory. Two of the hysterectomy specimens were from surgery done at varying intervals following radium and x-ray therapy. In both instances, however, the endometrial sections studied were from curettings taken just prior to the initiation of the radium therapy.

Criteria for the diagnosis of hyperplasia are difficult to list in a manner acceptable to everyone. Certainly the gradation from the normal proliferative endometrium to hyperplasia is gradual and insidious. Furthermore, even the most normal of endometria may show minor variations in different regions; also glands with a moderate degree of cystic dilatation may easily be found. The picture of full-blown hyperplasia makes for an easy diagnosis. In such instances there is marked variation in the size and the shape of the glands, rather noticeable pseudostratification of the epithelium in the glands; mitotic figures are numerous in both glands and stroma and many of the glands may be lined by bizarre or atypical-appearing epithelium. In some specimens the changes are so marked that there is difficulty in differentiating hyperplasia from adenocarcinoma. Errors in the diagnosis of hyperplasia, however, usually lie at the other end of the scale in that it is often difficult to decide whether one is dealing merely with an exaggeration of the normal variability of endometrium or an abnormality sufficient to justify the diagnosis of hyperplasia. At any rate, if we have made errors it has been in considering too many of these normally variable endometria as true hyperplasias. This, of course, would increase the incidence of hyperplasia of the endometrium in our series of cases.

### Findings

Hyperplasia of the endometrium was found in 4 (5.2 per cent) of the 77 specimens. Interestingly enough, only one of the hyperplasias was associated with invasive carcinoma. In the 73 endometria classified as normal, 27 were proliferative, 24 secretory, 4 atrophic and 3 menstrual. We have also included 15 endometria from pregnant patients, because pregnancy indicates a previously normal endometrium.

### Comment

It is obvious that the present authors consider that Bainborough's criteria for the diagnosis of hyperplasia of the endometrium are unusual. This impression is confirmed by the findings in his "unselected" control series where the incidence of hyperplasia was 69 per cent. This is truly an astonishing figure. Be that as it may, Bainborough's findings of such a startling incidence of hyperplasia associated with cervices that did not show carcinoma, and a very high (50 per cent) but still lower incidence in patients who did have carcinoma, does not bear out the hypothesis that "hyperestrinism" causes carcinoma of the cervix.

True, we have not included "controls" in this study. Our objective was to test the hypothesis that an important factor in the causation of carcinoma of the cervix is prolonged excessive stimulation with estrogens. If this were true, the endometria associated with carcinoma of the cervix (especially in the early stages, i.e., preinvasive) should show evidences of this prolonged stimulation, namely, a high incidence of hyperplasia of the endometrium. Such was not found. This hypothesis, therefore, seems unlikely.

Though a "control" series seems unnecessary to establish the validity of the hypothesis under discussion, the incidence of hyperplasia of the endometrium in unselected cases in this laboratory is of interest for comparison with that of other laboratories. Pathologic diagnoses are cross-filed in this laboratory. For some years this cross-file also included diagnoses of normal tissue such as normal endometrium. This latter includes secretory, proliferative, menstrual, and senile endometrium and endometrium of normal pregnancy (but not that associated with abortions). During this period of time the diagnosis of normal endometrium was made 2,684 times. During the

same period of time the diagnosis of hyperplasia of the endometrium was made 286 times. Thus in a truly unselected series the incidence of hyperplasia was 9.7 per cent. This incidence is numerically larger than the 5.2 per cent we found in the 77 patients who had carcinoma of the cervix.

### Conclusions

Neither our data nor the data of Bainborough support the hypothesis that prolonged and excessive estrogen stimulation is an important factor in the causation of carcinoma of the cervix.

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303 EAST CHICAGO AVENUE

## Department of Case Reports New Instruments, Etc.

### PREGNANCY COMPLICATED BY HYPERSPLENISM\*

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**P**RIMARY splenic cytopenia (hypersplenism) is a relatively new medical concept, having first been described in 1942 by Doan and Wiseman.<sup>1</sup> A review of the literature, however, does not reveal the recording of a case of primary splenic pancytopenia as a complication of pregnancy. It was thought that our experience with such a problem would be of interest to others in the field of obstetrics, who may encounter a similar hematologic complication.

The syndrome of hypersplenism is evidenced by a depletion of the cellular values of the peripheral blood, including neutropenia, thrombopenia, anemia, or any combination thereof, and is due to the acceleration of a normal splenic function to a pathologic degree. The normal clinical picture of the pregnancy may be altered due to the symptoms of anemia (weakness, fatigue, malaise, shortness of breath) or those due to an abnormal clotting mechanism (prolonged bleeding or clotting times, purpura, vaginal bleeding) and the abdominal findings may include a palpable spleen. Those having a further interest in this unusual splenic disorder are referred to some of the recent writings included in the references.

Mrs. M. A. (X-599), aged 33 years, para i, gravida iii, estimated date of confinement June 30, 1950, was admitted to the hospital on June 18, 1950, for the treatment of anemia and repeat cesarean section.

The patient's first hospitalization was Oct. 23, 1938, as a primipara, following forty hours of labor with ruptured membranes. X-ray pelvimetry revealed a cephalopelvic disproportion and a Munro-Kerr cesarean was performed. The laboratory data were: hemoglobin 11.0 Gm., red blood count 3.8 million, white blood count 13,000; Kolmer and Wassermann tests negative; urinalysis revealed nothing abnormal. The postpartum course was uneventful and the patient was discharged on Nov. 2, 1938.

The next admission was on May 11, 1943, for the treatment of a septic abortion and bilateral lobar pneumonia. The patient's therapy consisted chiefly of sulfadiazine, blood transfusions, and supportive measures. The point of interest concerning this admission is that even though she received twenty-two blood transfusions (250 c.c. each), it was possible to elevate her cellular elements only from hemoglobin 9.0 Gm., red blood count 2.9 million, white blood count 14,400 on admission, to hemoglobin 10.9 Gm., red blood count 3.2 million, white blood count 8,400 at the time of discharge.

The patient was again hospitalized Feb. 2, 1950, for the treatment of an anemia of pregnancy that was resistant to the usual therapy. The prenatal period of five months had been relatively uneventful until the diagnosis of anemia was made by her attending physician who placed her on liver and iron therapy with no response. She was then admitted to the hospital for studies and transfusions with the following blood picture: hemoglobin 5.0 Gm., red blood count 1.3 million, white blood count 2,850. Following trans-

\*Presented at a meeting of the Philadelphia Obstetrical Society, Oct. 4, 1951.

fusions of whole blood totaling 2,000 c.c., the blood values were raised only to hemoglobin 6.5 Gm., red blood count 2.1 million. The patient was then discharged to the care of her attending physician who continued therapy consisting of liver, iron, Rubramin, and folic acid, and returned to the hospital as an outpatient for transfusions which resulted in no significant change. Readmission was advised June 16, 1950, due to the failure of the above therapy and the proximity of her due date, June 30, 1950. At this time the patient complained of mild nausea, constant fatigue, and a progressive lassitude. The blood studies were hemoglobin 7.5 Gm., red blood count 1.7 million, white blood count 3,350; bleeding time, over ten minutes; coagulation time, 8 minutes; clot retraction time, none in two hours; platelet count, 8,640; bone marrow were stated to be normal (a previous aspiration was erroneously reported as hypoplastic); fragility test normal; serology negative; Coombs test negative; blood type A, Rh positive.

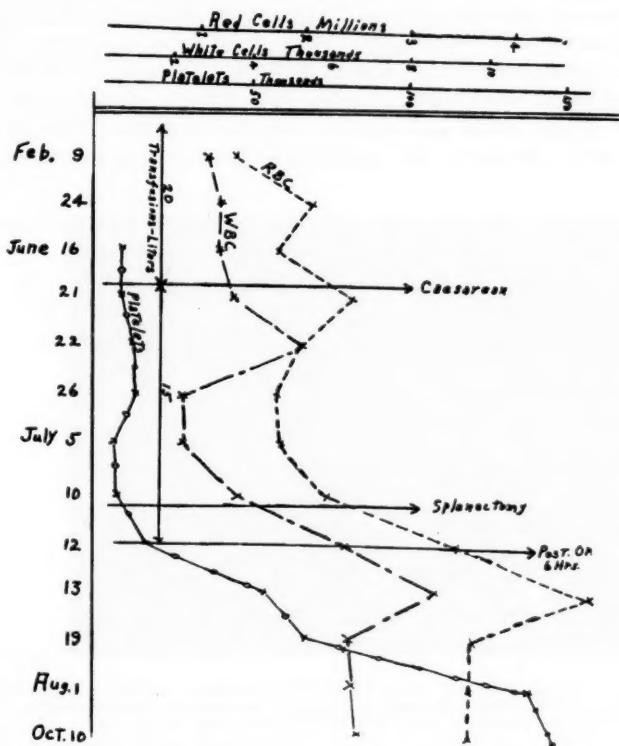


Fig. 1.—Graph of cellular values at different intervals during the study of the case.

The problem was then evidently the proper management of a patient with a living viable fetus who had had a previous cesarean delivery, who had an extremely poor hematologic picture, and in whom an uncontrollable postpartum hemorrhage could be anticipated due to the absence of the clotting mechanism. It was then decided to perform a cesarean hysterectomy (to control the postpartum bleeding) following a massive transfusion of 2,000 c.c. of blood. This was accomplished with considerable difficulty in controlling the bleeding areas (it seemed that every severed capillary produced a never-ending stream of blood). The delivered baby appeared normal except for a mild anemia (hemoglobin 12.0 Gm., red blood count 3.3 million, white blood count 19,500). A matter of interest at this point was the failure of 5,500 c.c. of blood in a period of twenty-four hours to produce any significant change in the mother's blood picture.

The postoperative course also produced no change in the blood status despite transfusions of 500 c.c. fresh blood daily (the abdominal incision was still oozing on the fourth

postoperative day). An x-ray of the long bones ruled out suppression of cell formation which would result from metastatic tumors, multiple myeloma, xanthoma, or osteosclerosis. Every method known to alter the clotting mechanism was unsuccessfully attempted. The diagnosis of hypersplenism was then made on the following criteria: (1) profound anemia, neutropenia, thrombopenia, (2) active bone marrow, (3) destruction of a huge quantity of transfused blood (33,000 c.c.), (4) the possibility of the blood dyscrasia dating back to the 1943 admission.

A splenectomy was then performed, the removed spleen weighing 340 grams (normal 100 to 150) with the patient receiving 2,000 c.c. of blood during the procedure. Six hours after surgery, the blood picture had changed from hemoglobin 6.4 Gm., red blood count 2.2 million, white blood count 1,800, platelet count 8,840, to hemoglobin 12.0 Gm., red blood count 3.4 million, white blood count 6,300, platelet count 16,850. The patient's clinical change postoperatively was amazing and she was discharged eight days after the splenectomy with a platelet count of 66,500. Three weeks postoperatively the patient returned for a follow-up blood study which was as follows: hemoglobin 12.0 Gm., red blood count 3.5 million, white blood count 6,400, platelet count 133,000, clotting time 3½ minutes, clot retraction time 2 hours; three and sixteen months later the follow-up values were relatively the same. Also, clinically, the mother and baby are in excellent health.

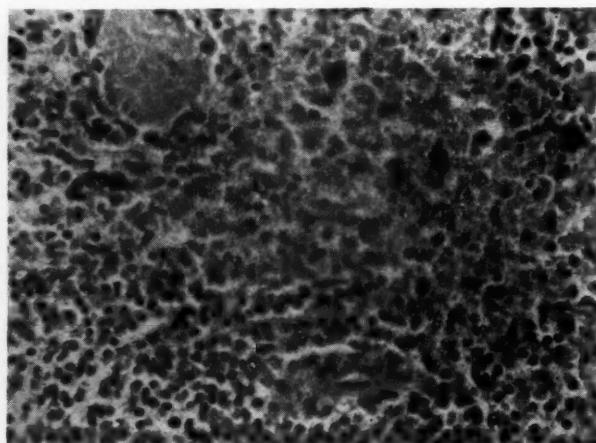


Fig. 2.—Section of the spleen the pulp of which contains a large number of red cells, prominent sinusoids lined with lush cuboidal cells, and numerous macrophages which contain such large quantities of blood pigment that the nuclei are not observed.

**Comment.**—The possibility of hypersplenism should be kept in mind when cases of pregnancy having peculiar or unresponsive types of anemias or unexplained postpartum hemorrhage are encountered. The diagnosis may have to be made without the splenomegaly being palpable (as in our case).

In subsequent discussions of the case, we were impressed by the absence of spontaneous purpura, even in the face of extremely low platelet counts (6,000 to 8,000). In attempting to answer this question, we received two explanations in personal communications: i.e., that the capillaries of some individuals were of unusual integrity, thereby preventing purpura without trauma, the other being that the purpuric syndrome depends upon the summation of the values of all the clotting factors (prothrombin, fibrinogen, vitamin C, and the platelets), not merely the reduced platelet count. Our attention was also drawn to the inability of the hormonal theory of cellular maturation arrest to account for the rapid destruction of 5,500 c.c. of transfused blood in 24 hours. A similar case could contribute some evidence for or against the theories of the pathology of the syndrome by determining the fetal cellular elements immediately before clamping of the cord and

24 hours later. If the theory of hormonal suppression of the bone marrow is correct, the values should be low first and then elevated later (after the source of the suppressing hormone is removed); however, if the mother's spleen is hyperdestructive, the values would be relatively normal at both determinations.

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## DERMOID CYST OF OVARY IN CHILDHOOD

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**W**HILE dermoid cyst of the ovary is a common lesion, it is seldom seen in patients under the age of 14 years and then most frequently is found as an incidental lesion. Costin and Kennedy<sup>1</sup> in 1948 found that about 200 ovarian tumors in infants and children had been reported in the literature; about one-fourth were dermoids. They reported 22 cases in patients under 14 years of age seen at the Mayo Clinic in 28 years; 7 were dermoids with the largest weighing 800 grams and measuring 15 by 12 by 11 cm. Blackwell and associates<sup>2</sup> reported 225 consecutive cases of dermoid cysts seen at the Mayo Clinic; four of these were in patients under 14 years of age and the largest cyst measured 30 cm. in diameter. Metcalf<sup>3</sup> reported a case of small bilateral ovarian dermoids in a girl aged 12 years.

The following case is of interest because of the youth of the patient, the huge size of the tumor, and the preponderance of nervous elements making up its structure.

P. W. (St. Mary's Acc. No. 27812), an 11-year-old white girl, was brought by her mother to a physician because of recent excessive weight gain and increasing size of the abdomen for the past four months. Examination revealed a well-developed girl with an exceedingly protuberant abdomen which was so tense as to make accurate examination impossible. She had very slight breast development, neither axillary nor pubic hair, and external genitals usual for her age. The extremities, face, and thorax showed no unusual fat deposition.

X-ray of the abdomen revealed a large mass arising from the pelvis and displacing the abdominal viscera upward; scattered bizarre areas of calcification were present within it. At surgery the mass arose from the region of the left ovary, was not adherent to other abdominal or pelvic structures, and presented the Fallopian tube stretched over a portion of its circumference. It was opened in the operating room and, because of its bizarre appearance and the clinical history, was felt to be malignant. The ovoid cyst had a smooth creamy pink surface, measured 33 cm. in greatest diameter, and weighed 4,300 grams. It contained about 2 L. of cloudy tan syrupy fluid in which floated varying-sized masses of greasy pasty white material. The inner surface was covered with nodular varying-sized brownish-red masses which generally presented broad pedicles (Fig. 1). Many of the nodular masses contained smaller cysts while others were made up chiefly of soft brown-red solid tissue (Fig. 2). Numerous areas of calcification were scattered throughout, making sectioning difficult.

Histologic sections showed some of the cysts to be lined by stratified squamous epithelium with the usual skin appendages, including hair follicles, in the underlying tissue. Others were lined by respiratory-type epithelium with underlying mixed mucous and serous glands. Here there was frequently a surrounding layer of smooth muscle with adjacent masses of hyaline cartilage so that the respiratory tract was recognizably mimicked (Fig. 3). The masses of brownish-red tissue, so prominent grossly, were made up of nervous tissue suggesting white matter of the central nervous system. One such area contained a small cystic structure bordered by ependymal cells and containing a choroid plexus (Fig. 4). In another area a small structure suggesting abortive retina bordered by choroid was present (Fig. 5). No areas suggesting malignancy were seen and the Fallopian tube was grossly and microscopically normal.



Fig. 1.—Ovarian dermoid after being opened.

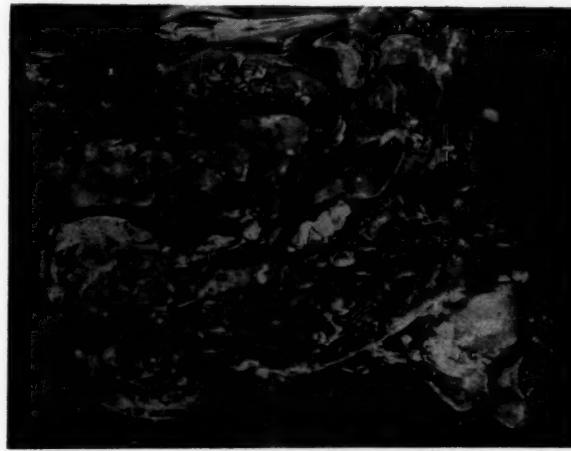


Fig. 2.—Cross section of dermoid. Note generally solid character.

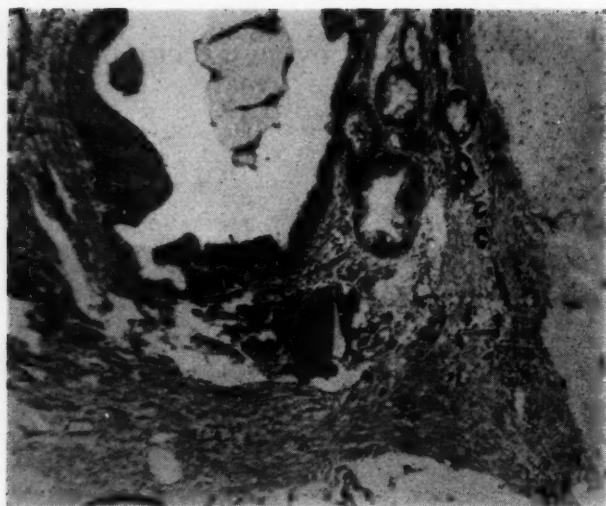


Fig. 3.—Photomicrograph showing "bronchus" lined partially by respiratory-type mucosa and showing cartilage and bone in wall. ( $\times 50$ .)

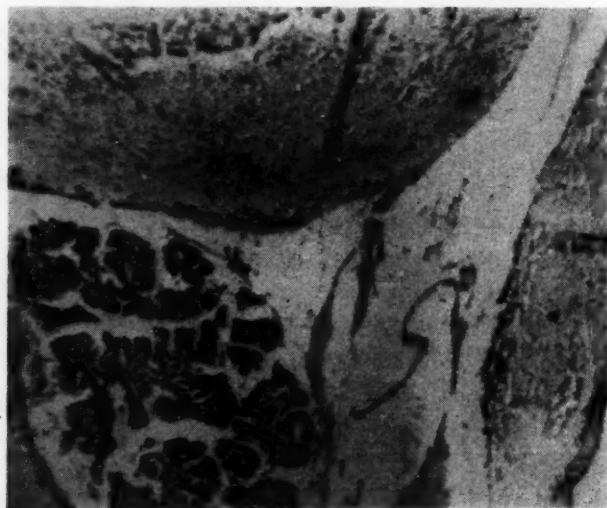


Fig. 4.—Photomicrograph showing choroid plexus, ependyma, and surrounding nerve tissue. Note covering of stratified squamous epithelium on left. ( $\times 50$ .)

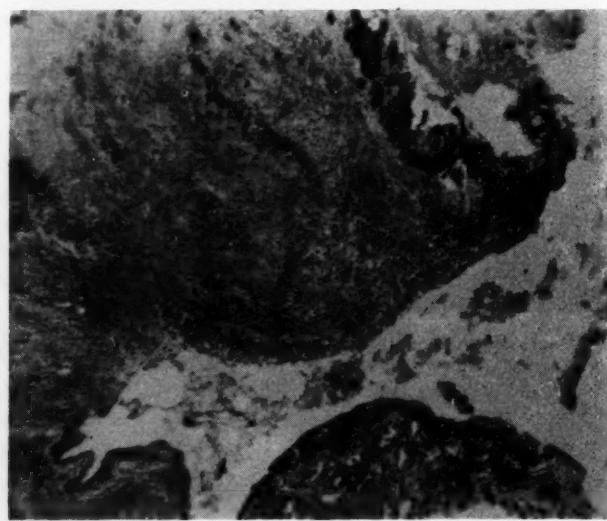


Fig. 5.—Photomicrograph showing abortive "eye." ( $\times 50$ .)

The child recovered uneventfully from the operation and is well with no evidence of recurrence eleven months after surgery.

*Summary.*—A large dermoid cyst of the ovary of an 11-year-old girl is reported. It was unusual for its size, its histological make-up, and the age of the patient.

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## **RUPTURE OF THE UTERINE SEGMENT AND BLADDER FOLLOWING CESAREAN SECTION**

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**R**UPTURE of the uterus and rupture of the bladder during pregnancy may occur separately or together. They may occur ante partum or intra partum; be due to external trauma or to obstetrical trauma; to weakened uterine wall due to adenomyosis (Stone<sup>1</sup>); to the scar of previous section; or to injury to the bladder at previous section for delivery. A febrile puerperium following cesarean section is recognized as predisposing to a weakened uterine scar. Rupture of the uterus occurs in about 1:2,000 cases. An incidence of 1 in 220 cases was reported by Whitaere and Fang<sup>2</sup> from the Peking Union Hospital in a series of 11,500 deliveries.

Mrs. M. H., aged 37 years, gravida iii, had had two pregnancies terminated by cesarean section, on account of an asymmetrical anthropoid pelvis, the first child having presented by breech. The first delivery was in January, 1946, the second in August, 1949. The pregnancies were uneventful. Low cervical sections were performed by the author both times, with longitudinal incisions through the lower segment. Both postoperative courses were afebrile and there were no bladder complications noted either time.

Mrs. M. H. registered for her third pregnancy May 12, 1950. The last menstrual period was February 18, and her expected confinement Nov. 25, 1950. The only complaint was slight morning nausea. Physical examination showed a 37-year-old woman, height 5 feet, 6 inches, weight 120 pounds, blood pressure 136/66, hemoglobin 84 per cent, red blood count 4.25 million, and white blood count 9,500. The differential count was normal. Kahn and Kline tests were negative. Her blood was Group A, Rh positive. The basal metabolic rate was plus 3 per cent, and plus 1 per cent. The urine was negative, tuberculin test negative.

The pregnancy progressed uneventfully. Her weight gain was 23 pounds, the blood pressure and urine were normal throughout. The child lay in right occiput anterior position, and the head was not engaged when the patient was admitted to the hospital November 14 for elective section and sterilization the following day. About 12:30 A.M. the patient was awakened from sleep by a sudden sharp pain in the lower abdomen, and felt the urge to void. She went to the bathroom, passed a small amount of bloody urine, and called the nurse.

When seen 15 minutes later the patient was still complaining of pain in the lower abdomen, which was acutely tender to palpation. No uterine contractions were made out, the fetal heartbeat was regular in the right lower quadrant, no boardlike rigidity was found, and there was no vaginal bleeding. The pulse and blood pressure were unchanged. A tentative diagnosis of rupture of the uterus was made and the patient taken to surgery. As is customary, a French catheter was inserted into the bladder preoperatively and left in place during surgery. No note was made by the nurse of bloody urine at this time, although only 30 c.c. were obtained.

General anesthesia was used. Pulse and blood pressure remained normal. The abdomen was opened by a low midline incision with excision of the previous scar. The abdominal cavity was free of blood and other fluid, and was protected by a large lap roll in the usual manner. The uterine peritoneum was picked up about 2 cm. above the bladder reflection and incised. At once the end of the indwelling catheter and the infant's shoulder came into view. The incision was carried laterally on both sides and after placing a lap sponge over the bladder and catheter, the child was readily delivered by lifting the head out of the uterus manually. The rent in the uterus was enlarged anteriorly 2 to 3 cm. in order to facilitate delivery. The child weighed 8 pounds, 2½ ounces, and cried spontaneously.

Uterine sinuses were now clamped by ring clamps and the placenta expressed. The bladder was inspected and found to have split transversely for its entire width. The bladder margins were picked up by Allis clamps, and covered by lap until the uterus was closed. The uterine tear was longitudinal through the old scar, and extended to the cervix below. The uterus was closed by two layers of continuous No. 1 chromic catgut, the second layer inverting the first. The bladder then was closed by No. 00 plain catgut, in two layers. Two Gm. of sulfathiazole were placed over the uterine lower segment and a piece of Oxycel was left at the lower end of the denuded area to control slight oozing. The bladder peritoneum was then sutured well above the upper end of the longitudinal uterine incision. Sterilization was done according to the Pomeroy technique, and the abdomen was closed in layers. A 5 c.c. Foley catheter was inserted into the bladder and left in place for 10 days. Glucose, 1,000 c.c. 10 per cent in saline, was given during the operation, and the transfusion begun on return to the room. The pulse, temperature, and blood pressure remained good. The lochia was normal, the urine in the drainage bottle remained bloody for three days, but thereafter was clear. The patient was out of bed on the first postoperative day, and was walking freely about the room on the third day, with the catheter still in place and attached to a small specimen bottle for convenience. On the ninth postoperative day the catheter was clamped off for an hour at a time, and the following day the catheter was removed, voiding was adequate, and the urine clear. The patient was discharged on the thirteenth postoperative day, with no urinary symptoms, the abdominal incision was well healed, and the uterus involuting normally. Penicillin was given during the entire time the catheter was left in place and for two days thereafter, to prevent, so far as possible, any urinary infection.

Follow-up examinations on Jan. 2, 1951, and June 19, 1951, showed a complete recovery, with entirely normal bladder capacity and function. Pelvic examination was normal, the uterus being well involuted and in good anteflexion, with clear vaults and clean cervix. The child, a normal female, was doing nicely. Cystograms done in October, 1951, showed normal bladder contours and position. The capacity was found to be normal.

A second case which the author saw in consultation and which illustrates rupture of the uterus through the lower segment scar of a previous section, but in which the bladder dissected itself free of the scar, and did not rupture, is that of Mrs. C. D., a white woman, aged 32 years, para i, gravida ii. There was a history of removal of a right parovarian cyst and right tube together with the appendix in 1946. She was delivered in December, 1928, by low segment cesarean section after 28 hours of labor, with no progress; at the end fetal distress developed, due to a short cord wrapped 3 times about the child's body. The child was resuscitated and the patient made an uneventful recovery, but for a single elevation in temperature on the third postoperative day to 102° F. There was cephalopelvic disproportion as well as fetal distress noted on the record.

On Nov. 14, 1949, the patient was admitted in labor at 5:30 A.M. The pains began the previous evening at 9:30 P.M., and on admission were severe, lasting 45 to 60 seconds and every 2 to 3 minutes. At 6:45 A.M. the author saw the patient in consultation. The abdomen was tense, exquisitely tender, the pains were extremely severe and almost continuous. Some blood clots were being passed. The pulse was 72, blood pressure 140/90, fetal heartbeat 136 and regular. A diagnosis of threatened uterine rupture was made and the patient taken to surgery at once, as rectal examination showed an unengaged head with overriding at the symphysis.

The abdomen was opened and no free blood or fluid was found in the abdominal cavity. When the serosa was incised to prepare the bladder flap, a large clot of blood was found over the lower segment and under the bladder which had dissected away from the uterus, which had ruptured longitudinally, and the child's head was visible in the aperture in the lower segment of the uterus. The rent was enlarged anteriorly and a living child delivered. The uterus was closed in the usual manner and the uninjured bladder sutured over the denuded lower segment. The patient recovered.

### Summary

Two cases are here reported, which were strikingly similar except that, in the second, the bladder itself did not rupture but acted as a tampon to the tear in the uterine lower segment, while, in the first case, rupture of the lower segment into the bladder took place. The second patient had been unwisely allowed to remain in hard labor for several hours before the consultant was called, and rupture had taken place when the patient was first seen by the author.

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22-C WEST MICHELTREONA STREET

## COMBINED EXTRAUTERINE AND INTRAUTERINE PREGNANCY\*

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(*From the Peck Memorial Hospital*)

THE first case was reported by Duverney in 1708 and was discovered at autopsy. Novak,<sup>1</sup> in 1926, reviewed the cases from 1708 to 1926, quoting Duverney, Zendi, Simpson, and Neugebauer. Gemmell and Murray,<sup>2</sup> 1931, Mathieu,<sup>3</sup> 1939, Sloat and Peterson,<sup>4</sup> 1938, made limited reviews and added more cases to the literature. Mitra<sup>5</sup> reviewed the literature from 1708 to 1940 and found that 304 cases had been reported. At this time, there was considerable confusion as to the number of cases reported, the total varying from 304 (Mitra<sup>5</sup>) to 368 (Ludwig<sup>6</sup>) depending upon the estimates used. Since that time, there have been two complete reviews: that of Studdiford and Speck<sup>7</sup> in 1944 and that of DeVoe and Pratt<sup>8</sup> in 1948 bringing the total number of cases reported to 395. Since the last report, six more cases have been added to the literature, and the case being reported in this paper will bring the total to 402.

These cases are of interest because of their infrequency, difficulty in diagnosis, and the mortality rate associated with them. The incidence, according to Scherman, is one in 30,000 pregnancies. Marten and Meyer<sup>9</sup> stated that this condition occurred once in every 105 ectopic pregnancies. DeVoe's incidence was one in every 125 ectopic pregnancies. The Mayo Clinic<sup>10</sup> reported two cases in 13,367 deliveries and Studdiford stated that at Bellevue the condition was encountered only once between 1918 and 1944. Lawrence and Elsemore<sup>11</sup> stated that in a series of 170 cases the correct diagnosis was made in only seven. This condition is considered to occur most frequently in the older age group. Seventy-six and eight-tenths per cent in the series were 26 years or older. Heterotopic pregnancy occurs with greater frequency in the multipara than in the primigravida. In DeVoe's series 70 per cent were multiparas, 14 per cent were primigravidas, and in 16 per cent of the cases the parity was not known. In Muller's report of 202 cases, the maternal mortality was 21 per cent, and the intrauterine fetal mortality was 61 per cent. In Keyes' report of 88 cases, 21 cases went to term. Faxon believed that 10 per cent of the cases reported represented intrauterine pregnancy implanted upon ectopic pregnancy. The majority of cases represent a twin pregnancy with implantation ectopically and entopically.

R. O. (No. 7294), a 38-year-old gravida vii, para iii, was seen at home on the evening of May 22, 1950. Her chief complaint was severe lower abdominal pain, cramplike in character. Her last regular menstrual period was March 8, 1950. She had been seen on April 25, 1950. A diagnosis of early pregnancy was made and her estimated date of delivery was Dec. 14, 1950.

The patient had two normal pregnancies, 17 and 20 years before, being delivered of normal female infants. There were no further pregnancies until July, 1940. At that time she was treated for an incomplete abortion. She had two dilatations and curettages done before a diagnosis of ectopic pregnancy was made. On Aug. 4, 1940, a right tubal pregnancy was removed. The patient had an extremely stormy postoperative course, being finally discharged six weeks after the operation. Between 1940 and 1946 she had two spontaneous abortions, both uneventful, and both pregnancies of about two months' duration. This patient was first seen on Jan. 20, 1946. Her chief complaints were meno- and metrorrhagia, combined with occasional periods of amenorrhea. The duration of these symptoms was about 14 months. General physical and pelvic examinations were essentially

\*Presented at a meeting of the Brooklyn Gynecological Society, Feb. 20, 1952.

negative at this time. She was kept under observation. Her symptoms became progressively worse. On Aug. 16, 1946, a diagnostic curettage was done. A large amount of endometrial tissue was obtained. The pathological diagnosis was endometrial hyperplasia.

Following the curettage she resumed a regular cycle of 28 days, the periods being five days in duration. The patient was seen again on Jan. 28, 1947. Her chief complaint was amenorrhea. Her last period was on Nov. 22, 1946. A diagnosis of pregnancy was made, the estimated date of delivery being Aug. 28, 1947. On several occasions she threatened to abort and was carried on increasing doses of stilbestrol (Smith and Smith routine) until the thirty-sixth week. During the last trimester of her pregnancy she showed some evidences of toxicity. She was carried on a high-protein, low-fat, low-carbohydrate, salt-free diet. On Sept. 19, 1947, she was delivered of a normal female infant weighing 8 pounds, 11 ounces. Her delivery and postpartum course were uneventful. Her periods returned to a regular cycle of 28 days, being five days in duration.

On April 25, 1950, the patient was seen again. Her chief complaint was amenorrhea. Her last regular period was March 22, 1950. A diagnosis of early pregnancy was made, the estimated date of delivery being Dec. 14, 1950. A prenatal course similar to that of her last pregnancy was advised at that time. The patient was not seen again until the evening of May 22, 1950.

Except for the nausea associated with pregnancy, the patient had remained well until May 22, 1950. During the afternoon of that day she began to experience left lower quadrant pain, cramplike in character. She went to bed with some relief but toward evening the pain returned with greater severity.

The blood pressure was 120/80, pulse 80, temperature 99° F., and respirations 20.

The patient was a well-developed white woman of good hemic component. She did not seem to be in distress. The general physical examination was negative. The abdomen was soft and there was no rigidity in either lower quadrant. An old, well-healed, mid-rectus scar, extending from the pubis to the umbilicus, was noted. There was some slight tenderness in both lower quadrants on deep palpation, but there was no rebound tenderness. The abdomen was tympanitic throughout. Pelvic examination revealed a parous introitus. The cervix was very soft and irregular in the axis of the vagina and extremely tender on motion. The uterus was enlarged to the size of a three months' pregnancy. It was fixed, not tender. The adnexa could not be felt. There was a large sausage-shaped mass pushing into the cul-de-sac. The mass was extremely boggy and very tender. There was no discharge and no sign of bleeding. *Opinion:* ectopic pregnancy.

Laboratory findings on admission, May 22, 1950, were as follows: hemoglobin 90 per cent, red blood count 4.13 million, white blood count 7,350, polymorphonuclear leukocytes 66 per cent, stab forms 2 per cent, large lymphocytes 31 per cent, monocytes 1 per cent, blood type O, Rh positive, and urine negative.

*Operative Findings.*—There was very little free blood in the abdomen. The uterus was larger than expected, being the size of a 4 to 4½ months' pregnancy. Examination of the uterus revealed the absence of the right tube and ovary. The left tube was located and traced downward and posteriorly into the cul-de-sac. The tube was enlarged for a distance of 9 cm. and the mass was 3 cm. in diameter. The mass was surrounded by many large blood clots and was adherent to the posterior wall of the uterus and to the cul-de-sac. The appendix was found to be incorporated in this mass.

*Operation.*—By gentle finger dissection the mass was freed from the uterus and cul-de-sac and brought into the operative area. The tube was then ligated and cut. The appendix was then separated from the mass and was found to be enlarged and reddened at the tip. The appendiceal mesentery was gangrenous. The tubal mass was then removed. The appendix and mesentery were then ligated and cut. The appendiceal stump was carbolized and dropped back into the abdomen. Fresh bleeding was noted, and a small rent in the posterior wall of the uterus was found. The rent was clamped and tied off.

with a plain No. 00 suture ligature. The remaining free clots were removed. Inspection revealed no further bleeding, and the incision was closed in the usual manner. The patient received 1,000 c.c. of 6M sodium lactate and 500 c.c. of citrated blood.

The patient's postoperative course was uneventful and she was discharged on the eleventh postoperative day.

*Pathological Findings.*—(1) Perforated ectopic pregnancy in left Fallopian tube; (2) acute periappendicitis with decidual tissue in serosa.

The Aschheim-Zondek test of June 1, 1950, was positive.

*Postoperative Diagnosis.*—(1) Ectopic pregnancy, ruptured, left; (2) acute periappendicitis; (3) intrauterine pregnancy.

*Follow-up.*—Office visits were resumed on June 13, 1950. There were no complaints. The abdominal scar was well healed. The uterus measured 16 cm. above the pelvic brim. The blood pressure was 130/80, urine negative, weight 144½ pounds. The patient felt fetal movements on July 3, and the fetal heart was heard on July 11.

From this time on she became difficult to manage. There was a gradual, but progressive rise in blood pressure, reaching as high as 150/90. The urine always remained negative. She was placed on a high-protein, low-fat, low-carbohydrate, salt-free diet. Fluids were restricted to 1,000 c.c. per 24 hours. She was given magnesium sulfate daily by mouth, and placed on bed rest. The blood pressure fell to 140/90, and remained at this level. On Sept. 21, 1950, the hemoglobin was 82 per cent, red blood count was 4 million, urine negative. She went into labor on Dec. 18, 1950, and following two hours of good pains she was delivered of a normal female infant weighing 9 pounds, 3 ounces. The delivery and postpartum course were uneventful, and she was discharged on the sixth postpartum day.

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## SCAPHOCEPHALY OF THE NEWBORN

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THE following case is deemed worthy of presentation because of its great rarity as an entity of obstetrical importance.

Mrs. E. W., gravida ii, aged 22 years, was first seen July 14, 1951. Her last period was Feb. 3, 1951, expected date of confinement Nov. 10, 1951. There was no history of operations, transfusions, or serious medical illnesses. Her blood was type 0, Rh negative. Her mother had had five children without any difficulty. There was no history of any malformations. The patient stated that in July, 1950, she delivered a baby after "a long, long labor of two days and a high forceps operation." The baby weighed 6 pounds, 5 ounces. She was told the baby was hydrocephalic. The history as obtained from the hospital stated that the patient had a 22 hour labor, terminated by low forceps to a transverse occiput position. "The baby was reported to have a somewhat high-pitched cry and be jittery. Most striking thing on physical examination is large head which measures 15 inches (37.5 cm.), chest only 12 inches at the most. . . . The fontanelle is not unusually large and is not full or bulging. General physical examination negative. Doctor is not sure if there is any central nervous system trouble here or not; see nothing to be done at this time, but child will bear close watching here and on outside, especially for hydrocephalus." The child, when 3½ months old, was admitted to the Children's Hospital in Boston, Mass., because of persistent large head size and drowsiness. The head circumference was 45.7 cm. and anterior fontanelle 4.5 by 5 cm. Following ventriculography, ventricular and lumbar taps, encephalography, and right parietal craniotomy with partial excision of the choroid plexus, the discharge diagnosis was congenital communicating hydrocephalus. The head circumference at 19 months of age was 53.5 cm. There was mental retardation.

During her second pregnancy, the patient was seen at regular intervals. On Sept. 29, 1951, there were no antibodies in albumin or saline. The Coombs test was negative. On Oct. 20, 1951, x-rays were taken. They revealed a flat inlet. The head was peculiarly shaped, being excessively long in the occipitofrontal diameter. It was not directly over the inlet, being somewhat to the left of the entrance to the true pelvis. In the antero-posterior film, the head seemed poorly flexed, although in the lateral film it was attempting to enter by the suboccipitobregmatic diameter. Consultation was held and it was felt that this head was abnormal and unusually long and, in view of the past history and the patient's great fear of another difficult labor, that, unless the head came quickly into the pelvis, a section would be safer and easier for the patient. That the baby might well be abnormal was taken into consideration. The patient was admitted to the Mount Auburn Hospital on Nov. 8, 1951. She had strong labor for two hours. Vaginal examination under nitrous oxide and oxygen anesthesia revealed a cervix which was rather fibrous, about 2.5 cm. in length, closed but admitting a finger and with the head floating and quite ballotable. An extraperitoneal cesarean section was decided upon in preference to expectancy and possible dystocia, and was performed without event. The baby, a female, weighed 6 pounds, 5 ounces. Examination revealed a child crying vigorously and quite cyanotic. There was a very loud blowing murmur over the precordial region. The head was oddly shaped. There were no parietal bosses. There was a protuberance in the frontal region extending sharply forward and upward. The head was quite hard, the posterior fontanelle being completely closed and the anterior fontanelle very nearly so.

In addition to the absence of the parietal bosses, the head sloped upward toward the closed sagittal suture. The occiput also was prominent so that the whole appearance of the head was scaphoid or boat shaped. The child lived two days. Postmortem examination stated that the head was "excessively long and narrow. Multiple congenital abnormalities. There was bleeding into all the ventricles of the brain, distention of the lateral ventricles and generalized edema of the brain; congestion and edema of the lungs; cyanosis of lips and nailbeds. Multiple congenital anomalies: Incomplete separation of the right middle lobe, closure of posterior fontanelle, disfigured pinnae, bilateral ureteral strictures, two distinct uterine cavities and two vaginas, incomplete stricture of the common duct; mobile cecum and ascending colon; short mesenteric attachment at point of origin." Additional report: "Review of the case indicates the disease process producing the baby's death is congenital alveolar dysplasia, a structural anomaly of the lungs. The intracranial hemorrhage found grossly is probably secondary to anoxia." Unfortunately the head was not measured. The roentgenogram occipitofrontal diameter was 13.5 cm., but this of course may have been distorted.

### Comment

The general term used to characterize the condition present in the case just described is craniostenosis, a term first given, according to Ford,<sup>1</sup> to this condition by Virchow. He further states that Virchow applied this term to a certain group of malformations of the skull in which premature synostosis of two or more cranial bones occurred, causing an increase in cranial pressure, a malformation of head, and other symptoms. Parks and Powers<sup>2</sup> show that these conditions are dependent upon a defect in the germ plasm. This opinion has gained ground in recent years. Ford<sup>1</sup> states: "A number of possible malformations may be expected depending upon the suture or sutures involved." The condition has many eponyms (Curzon's disease, Apert's disease, etc.). The commonest type of craniostenosis is oxycephaly. Here the skull is flattened, both anteroposteriorly and laterally. The forehead is generally receding, the occiput is flat, and there is a great height to the head. Because of the last feature, the height, it is sometimes called tower skull or steeple skull. Acrobrachycephaly is very similar and often confused with oxycephaly. The essential difference from oxycephaly is that while the head is flattened and shortened anteroposteriorly, the width of the head is greatly increased, not decreased as in oxycephaly. In scaphocephaly or boat-shaped head, there is a marked decrease in the transverse diameter, but a marked increase in the anteroposterior diameter. The case here described is one of scaphocephaly. A review of the literature reveals that stenosis may take place to a varying degree at different stages of development, either intrauterine or postnatal. Nearly always the fontanelles are open at birth. No cases have been encountered of oxycephaly or acrocephaly where both the fontanelles were closed or nearly closed at birth. Nearly always the anterior fontanelle is extremely large. The case report here is extremely rare in that the posterior fontanelle was completely closed and the anterior fontanelle nearly so, so that the cranium was rigid and unyielding. Molding in this case would have been impossible. Oxycephaly and acrobrachycephaly rarely cause dystocia. Oxycephaly is rare as a cause of dystocia, because neither the anterior, posterior, nor lateral diameters are increased. They are in fact usually decreased. In addition, the head is moldable because the fontanelles are usually wide open. If, however, internal hydrocephalus is present to a marked degree, the hydrocephalic aspect may in rare instances be marked enough to cause dystocia. In acrobrachycephaly alone the lateral diameter is increased and this with or without hydrocephalus may cause, rarely, dystocia. Parks and Powers reported two cases of scaphocephaly: the first, from the literature, had no history of obstetrical difficulty; in the second, a personal case, labor was premature by twenty-three days, and lasted for forty-eight hours. The labor was terminated by high forceps. The baby's scalp was badly lacerated and the child was very cyanotic at birth and not expected to live. Of the twenty-seven cases of oxycephaly collected from the literature by Parks and Powers, the obstetrical history was

given in only nine. Seven had no dystocia. In one "instruments had been used." The fontanelles were open at birth, the anterior widely so. Another labor was described as "rather difficult." The infant in this case, at 4 years of age, had a head the circumference of which was only 17½ inches (43.75 cm.), as against a normal of 34 cm. at birth. The only reference found in the obstetrical literature to craniostenosis is that of Harrar.<sup>3</sup> This is a case report of oxycephaly. The baby weighed 4,425 grams and was normally delivered. The x-rays showed craniotabes, unusually large fontanelle, and elongation of the frontal region. The picture of the child shows a flat occiput and a typical oxycephalic head (tower or steeple head) with a short anteroposterior diameter. This is the type of case which because of short diameters and open fontanelles should not cause dystocia. Potter<sup>4</sup> illustrates a case of scaphocephaly, but it is not a particularly good picture. The excessive anteroposterior length so characteristic of scaphocephaly is not very evident in the photograph. Murphy,<sup>5</sup> in his monograph, "Malformations of the Newborn," does not mention craniostenosis or its varieties acrocephaly, oxycephaly, and scaphocephaly. The diagnoses were obtained from birth certificates and hospital records and it is possible that some of the diagnoses of hydrocephalus may have been essentially cases of craniostenosis, the internal hydrocephalus often present in this condition not being a primary factor. Greig,<sup>6</sup> in his classic description of the condition, discusses examples of oxycephaly and acrobrachycephaly in great detail, but does not describe scaphocephaly.

### Summary

1. A case of scaphocephaly in the newborn is presented. It is unusual in its very early development of stenosis of the sagittal suture, the marked closure of the fontanelles, and the extreme anteroposterior length. The patient was delivered by extraperitoneal cesarean section, in preference to expectant treatment and forceps. She had previously delivered a baby with hydrocephalus.

2. A review of the literature reveals but one reference to scaphocephaly as a cause of dystocia.

3. Two of the varieties of craniostenosis, oxycephaly and acrocephaly, should be extremely rare causes of dystocia, because (1) the diameters of the head are less than usual and (2) the fontanelles are open. It is probable that when they do cause dystocia it is because of an accompanying hydrocephalus.

4. That variety of craniostenosis called scaphocephaly with its increase in the antero-posterior diameter can cause dystocia if the stenosis of the suture lines occurs to a marked enough degree in utero to cause closure of the fontanelles and resulting cranial rigidity. A review of the literature reveals, however, that the stenosis is rarely marked enough, or early enough, to do so.

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## CHEMICAL BURNS OF THE VAGINA WITH SEVERE HEMORRHAGE

### Report of Four Cases

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THE use of a strong water-soluble oxidizing disinfectant as a douching agent constitutes a grave danger to the patient, yet such substances are commonly used by women acting upon their own initiative or on the recommendation of their physicians.

One of the more frequently employed oxidizing disinfectants which is used sometimes as a cleansing douche and other times as an abortifacient is potassium permanganate. This substance is easily available in tablet form or as loose purple crystals. It is a deodorant and germicide, its germicidal action being dependent on the release of its nascent oxygen. Davison has stated that oxygen in its nascent state is capable of oxidizing all organic materials almost immediately. Potassium permanganate when applied locally to mucosal surfaces in a concentrated form exerts a strong caustic effect which may result in slough, massive bleeding, and eschar formation.

The following are four such cases which were seen on the gynecological service of the Jersey City Medical Center recently.

CASE 1.—Mrs. H. G. (No. 477839), a 23-year-old Negro gravida ii, para i, was admitted Feb. 13, 1951, with a chief complaint of vaginal bleeding. Her last normal menstrual period had occurred on Dec. 12, 1950, and lasted five days. The patient, believing herself to be pregnant, had inserted a potassium permanganate tablet into the vagina the evening prior to the day of admission. Eight and one-half hours later the patient awakened with severe vaginal bleeding necessitating the use of six to eight pads, a small towel, and stated that "more went on the floor." The patient was without pain but felt faint and experienced seotomas.

Her blood pressure was 84/50, pulse 100, respirations 22.

Pelvic examination revealed the cervical os to be closed and clean, and the vagina filled with clots. These were removed and an irregular 2 cm. escharotic area was seen in the anterior vaginal wall just anterior to the cervix. No active bleeding was noted from the cervical os or the burned area at the time of admission. The uterus was enlarged to the size of an eight weeks' gestation. The diagnosis was chemical burns of the vagina with hemorrhage and shock and early intrauterine pregnancy. The red blood count was 3.6 million, hemoglobin 12.0 Gm. and white blood count 8,400. Treatment consisted of transfusions with whole blood, a vaginal pack for twenty-four hours, and instillation of a sulfonamide cream. No further bleeding occurred and the patient was discharged as improved on Feb. 19, 1951.

CASE 2.—Mrs. B. W. (No. 484366), a 21-year-old gravida iv, para iv, was admitted on May 20, 1951, with a chief complaint of vaginal bleeding of five hours' duration. She had had her last menstrual period from April 14 to 19, 1951. Because her menstrual period was four to five days overdue in May, the patient inserted two small cylindrical "black pills" into the vagina with the intention of causing an abortion. Nine hours

after inserting the pills into the vagina, the patient began to bleed heavily and painlessly, soaking a dozen pads and a bed sheet. Every time the patient voided blood gushed from the vagina. This was associated with four fainting spells. The blood pressure was 70/0, pulse 140, and respirations 24.

The patient was in a state of shock on admission and blood replacement was immediately started. Her condition rapidly improved following the administration of 1,000 c.c. of whole blood and oxygen under pressure.

Pelvic examination revealed the cervix to be firm, pointing down and back, and not tender to motion. The corpus uteri was enlarged in the anteroposterior diameter but was firm. In the right adnexal region was felt a firm, ballotable, nontender mass the size of a golf ball. Through the left fornix was felt a diffuse bulging that was nontender. The cul-de-sac was free of masses. Speculum examination revealed three blackened areas each the size of a quarter near the cervix in the vaginal mucosa at one, three, and six o'clock. These were thought to represent third-degree chemical burns. No active bleeding was seen coming from the cervix.

The red blood count after transfusion with 1,000 c.c. of whole blood was 4.12 million with 13.5 Gm. hemoglobin, and the white blood count was 18,800. Diagnosis was made of chemical burn of the vagina with hemorrhage and shock, hematoma of the perivaginal connective tissue, and right ovarian cyst.

Local treatment consisted of placing petrolatum gauze strips into the vagina over the burned area and then packing the vagina for twenty-four hours. Subsequently the patient was treated with vaginal instillations of a sulfonamide cream, and was discharged as improved on May 29, 1951.

CASE 3.—Mrs. R. L. (No. 498109), a 30-year-old Negro gravida iii, para iii, was admitted on Jan. 17, 1952, with the chief complaint of vaginal bleeding. Her last menstrual period had been December 17, 1951. The day before admission the patient had inserted a "small black tablet," potassium permanganate, into the vagina to prevent conception. Subsequently she began bleeding heavily and passed large clots. There was no associated abdominal pain or cramps. Shortly after admission the patient bled about 250 c.c.

The blood pressure was 124/80, pulse 96, respirations 22.

Pelvic examination revealed a clear mucous plug in the external os, and no bleeding from the cervical canal was seen. Also noted was a black chemical burn approximately 2 by 4 cm. in size on the left lateral vaginal wall. Numerous bleeding points were present in this area. No other pathology was found on this examination. The red blood count was 3.15 million, hemoglobin 11.2 Gm., white blood count 13,500. Treatment consisted of a 500 c.c. whole blood transfusion, compression packing with Oxycel gauze and vaginal packs. Packing was removed twenty-four hours later and one small bleeding point was controlled by coagulation with a silver nitrate stick. The patient was discharged as improved on Jan. 24, 1952, on sulfonamide cream instillations.

CASE 4.—Mrs. C. F. (No. 500719), a Negro gravida iii, para iii, was admitted on Feb. 29, 1952, with the chief complaint of severe vaginal bleeding. Her last menstrual period had been Jan. 27 to 31, 1952. The patient stated that it had been her habit for the past three years to place a potassium permanganate tablet in a quantity of warm water to use as a cleansing douche. She routinely douched before and after the menses. Eleven hours prior to admission the patient, expecting her menses, took a potassium permanganate douche as mentioned. She was not sure that the tablet had dissolved completely. At 6:00 A.M. vaginal bleeding ensued and by 9:30 A.M. it was of such degree that the patient sought admission to the hospital. There was no associated pain but she felt weak and dizzy.

The blood pressure was 110/80, pulse 120, respirations 22.

Pelvic examination revealed the cervical os to be lacerated and not dilated. The cervix was in the axis of the vagina and there was a minimal amount of blood in the cervix. Just above the cervix on the anterior vaginal wall was seen a 3 by 2 cm. black eschar from which arterial blood was spurting for a distance of two feet. The bleeding was controlled

by suture ligatures, as vaginal packing failed to effect hemostasis. The red blood count was 3.7 million, hemoglobin 10.5 Gm., and white blood count 10,300. Treatment in addition to that previously mentioned consisted of a 500 c.c. blood transfusion. The patient was discharged as improved on March 5, 1952, with sulfonamide cream instillations.

*Comment.*—In three of the cases mentioned, potassium permanganate in tablet form was applied directly to the vaginal mucosa with the reported results. In the fourth case an attempt was made to prepare a solution of the potassium permanganate but apparently complete dissolution of the tablet did not occur with results approximating those of the first three cases.

The use of potassium permanganate as a cleansing douche or as an abortifacient is apparently not uncommon; it is not an innocuous procedure but rather one fraught with grave danger. One may readily believe that accidents of this nature have been repeatedly seen wherever potassium permanganate is used intravaginally but despite this there is a marked paucity in the literature of such case reports. It is hoped that with the above in mind, the use of potassium permanganate intravaginally in any form by the patient herself will be condemned by the physician.

### Summary

Four cases of chemical vaginitis secondary to the use of potassium permanganate are presented. Severe bleeding was present in all of the patients. The use of potassium permanganate vaginally is discouraged.

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## HYDRONEPHROSIS COMPLICATING PREGNANCY

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**I**N PRACTICE, there is a tendency to overlook lesions outside the genital tract which may complicate pregnancy. Pelvic masses that appear during pregnancy are commonly assumed to be ovarian cysts or fibroids. Consequently, hydronephrosis, congenital cysts of the kidney, and horseshoe kidneys, all of which are not infrequently responsible for a differential diagnosis of pelvic masses, are not routinely considered.

L. F., a 17-year-old Puerto Rican woman, was admitted to the Beth David Hospital on Dec. 1, 1950, complaining of marked abdominal discomfort and pressure on the right side of 24 hours' duration. Family history was essentially negative. There was no past history of kidney disease, fever, or chills. Menstrual periods since she was 15 years old had been always regular and normal. Her last menstrual period on March 23, 1950, placed her expected date of confinement on Jan. 28, 1951.

Physical examination on admission revealed a well-developed, well-nourished woman in no acute distress. General physical examination was negative. The abdomen was markedly distended and tense. Two distinct abdominal masses were palpated. On the left side, rising out of the pelvis, was a soft, cystic mass the size of a 7 months' gestation, in which fetal parts were palpated. The fetal heartbeat was heard in the lower left quadrant, 138 per minute, normal and regular. To the right of this mass, superimposed and encroaching on it, was another cystic mass which was tense and tender, extending from the posterior aspect of the uterus on the right side to the undersurface of the right costal margin. This mass filled the entire right flank and appeared to extend posteriorly, with a distinct cleft where it ended. Vaginal examination revealed a two-finger introitus; the cervix was soft, pointing posteriorly, the uterus anterior and to the left. The lower pole of a mass in the right adnexa appeared to blend with the mass palpated abdominally on the right side.

Laboratory findings on Dec. 1, 1950, revealed the following: urine was negative for albumin and sugar. Microscopic examination revealed 12 red blood cells per high-power field, and a moderate number of white blood cells. Hemoglobin was 75 per cent; there were 3.2 million red blood cells, 5,250 white blood cells, 64 polymorphonuclears, 28 lymphocytes, 4 monocytes, 4 eosinophils. No blood chemistry was performed since no kidney pathology was suspected. A flat plate of the abdomen taken on Dec. 1, 1950, revealed a single fetus in utero, approximately 7 months in development. A density on the right side of the abdomen deviating the uterus and the fetus to the left was described as a soft tissue mass with no evidence of calcification and no definite borders. The x-ray diagnosis was that of an ovarian tumor or cyst and a normal uterine pregnancy of seven months' development.

The clinical diagnosis was a large ovarian cyst complicating pregnancy. In view of the size, tenseness, and tenderness of the mass, with the history of marked abdominal discomfort in the 24 hours prior to admission, it was decided to remove the ovarian cyst. The danger of twisting, hemorrhage, or rupture of the ovarian cyst was responsible for the decision to operate without delay.

On Dec. 2, 1950, 36 hours after admission, a laparotomy was performed. On opening the peritoneal cavity, the uterus was found to be anterior and the size of a 7 months' gestation. Both ovaries were normal and in correct position. Pushing the uterus to the left was a large, cystic, retroperitoneal mass, covered anteriorly by the cecum and ascending colon. The mass extended from the brim of the pelvis on the right side to the under-

surface of the liver, and measured approximately 40 cm. in length. At this time, the mass was identified as a large cyst of the right kidney. The left kidney was normal in size. The peritoneum lateral to the cecum and ascending colon was incised, and the mass was then exposed, and seen to blend with the kidney. The ureter was identified, traced into the bladder, and found to be slightly hypertrophied. The mass was separated, punctured, and 5,300 c.c. of clear urine obtained. The renal vessels were then identified and ligated, and the kidney was removed.

*Pathological Findings.*—The pathological findings revealed an enlarged kidney measuring 15 em. in width and 20 cm. in length. There was a marked dilatation of the pelvis measuring 20 cm. in its largest diameter, and presenting an irregular sac. The wall of the sac was thick, its mucosal lining deeply hemorrhagic and in places ulcerated. The cortex of the kidney was yellowish pink in color. The medulla was absent. The pyramids were shelled out and formed large cavities. The microscopic diagnosis was massive obstructive hydronephrosis with acute pyelonephritis.

A blood chemistry taken at the time of operation was within normal limits, urea nitrogen measuring 17.5 mg. per cent and the blood sugar 156 mg. per cent. Urine examination at operation was negative. Urine specimens taken on December 4, 5, and 6 revealed only occasional white blood cells. Blood count on Dec. 4, 1950, revealed 67 per cent hemoglobin, 3.5 million red blood cells, 7,350 white blood cells, 78 polymorphonuclears, 20 lymphocytes, 1 monocyte, and 1 basophil.

On the second postoperative day, the patient went into spontaneous labor, and was delivered with low forceps of a living male child weighing 3 pounds and 6 ounces in good condition. She was discharged on Dec. 22, 1950, 22 days after admission, 21 days postoperatively and 18 days post partum.

*Comment.*—The case presented is that of a large hydronephrosis complicating pregnancy, erroneously diagnosed as an ovarian cyst. In view of the danger of rupture or torsion, a laparotomy was decided upon. No further urological examinations were made since urinary findings were normal, and the x-ray examination did not arouse suspicion. A large hydronephrosis is rather rare during pregnancy.<sup>1, 2</sup> Every gravid woman, however, shows some changes in the urinary tract, from slight dilatation to the extreme degree of hydronephrosis and hydroureter discovered in this case. The possibility of urological complicating factors in pregnancy should always be considered in the diagnosis of pelvic masses.

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## CARDIAC ARREST DUE TO THE USE OF PITUITRIN FOLLOWING NORMAL DELIVERY

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SINCE its introduction to obstetrics in 1909 by Bell, the use of posterior pituitary extract has been the subject of controversy.<sup>1</sup> The dangers associated with the use of this extract may be either primary shock, anaphylactic reaction, or tetanic convulsions, at times resulting in a fatal outcome.<sup>2</sup>

Pituitrin shock is a specific clinical entity<sup>3</sup> and is included among the causes of cardiac standstill.<sup>4</sup> This phenomenon is produced by the pressor substances within the extract. The relationship of Pituitrin-induced electrocardiographic changes to alterations in the coronary circulation was demonstrated experimentally by Melville in 1938.<sup>5</sup> As a result of coronary artery spasm, myocardial ischemia ensues with depression of the cardiac output.

Reports of increased incidence of shock with Pituitrin in sensitive or sensitized individuals;<sup>6</sup> in association with barbiturates;<sup>7</sup> and with cyclopropane anesthesia<sup>2</sup> have appeared in the literature. These reports suggest the potentiation of the cardiac effects of Pituitrin by superimposing the myocardial depression produced by barbiturates and cyclopropane.

The case being reported is one of fatal cardiac arrest after normal delivery in a primipara, following the injection of Pituitrin.

M. K., a 30-year-old white gravida i, para 0, was admitted to Parsons Hospital, Flushing, New York, at term. Prenatal history noted an extreme anxiety and "fear of death" throughout the pregnancy. There was a weight gain of 40 pounds and an increase in blood pressure to 138/80 in the last trimester, which returned to 120/80 when the patient was put on a salt-free diet and magnesium sulfate. Urinalysis was consistently negative.

On admission at 2:55 P.M. Jan. 22, 1952, the amniotic sac had ruptured and a slight bloody show was present. Blood pressure was 140/80. Complete cervical dilatation occurred on Jan. 24, 1952, at 7 A.M., and a normal male infant was delivered at 8:50 A.M. by low forceps and episiotomy. Anesthesia by resident consisted of nitrous oxide and oxygen for induction and open ether for maintenance. Slight cyanosis was present during induction but maintenance was uneventful. The patient's condition was satisfactory during the procedure. Anesthesia was discontinued at 9:10 A.M. and the patient began to react from anesthesia at 9:15 A.M. At 9:20 A.M. the placenta was delivered by the Credé maneuver and immediately afterward 10 international units of obstetrical Pituitrin and 0.2 mg. of methylergonovine tartrate were given intramuscularly. The condition of the mother and baby appeared good at this time. At 9:45 A.M., twenty minutes after injection of Pituitrin, the patient suddenly became pale, began sweating profusely and blood pressure fell to 50/0, with a pulse of 120. Coramine, 2 c.c., was given with oxygen by mask.

At 10:45 A.M. the patient's condition became much worse. Five hundred c.c. of blood plasma were administered. An endotracheal tube was passed and 100 per cent oxygen given by positive pressure. Five hundred c.c. of whole blood with procaine, 100 mg., were given very rapidly. The heartbeat and the patient's color appeared to improve slightly. At 11:25 A.M. the heartbeat stopped.

Thoracotomy was performed immediately and rhythmic, manual cardiac massage instituted, artificial respiration being carried out continuously. Five hundred c.c. of whole blood were again given and a mixture of 10 c.c. calcium chloride and 0.5 c.c. 1:1,000 epinephrine was injected into the left ventricle.

At 11:43 A.M. the heart began to beat again. An electrocardiogram taken at that time showed an idioventricular rhythm with a rate of 28 per minute. After thirty seconds, the heart stopped again. For two hours, cardiac massage and artificial respiration were continued. Ten c.c. of adrenal cortical extract and 300 mg. of procaine hydrochloride and

amide were given intravenously. Calcium chloride and epinephrine were injected twice again (once more in the left ventricle and once in the right auricle). On a few occasions during this time, the heart would beat for about 10 seconds and then stop. Electrocardiogram taken each time demonstrated the same idioventricular rhythm. At 1:25 P.M., the patient was pronounced dead.

Postmortem examination (by S. B.) was performed four hours following death. The significant findings consisted of many punctate areas of hemorrhage in the myocardium, endocardium, and pericardium, the changes being most prominent in the interventricular septum. The brain (including the pituitary), which was sectioned after fixation, showed focal areas of necrosis. Pulmonary emboli and cerebral hemorrhage were specifically looked for and eliminated as etiological factors. The uterus and adnexa revealed no injury consistent with surgical shock. Exsanguination as reflected by pallor of the viscera could be excluded since the organs generally showed venous congestion.

*Cause of Death.*—Diffuse focal hemorrhagic myocarditis, probably secondary to coronary spasm.

*Comment.*—Shock secondary to Pituitrin is not an uncommon event. This reaction is due to the constriction of the coronary vessel which the drug produces. The effect is exerted regardless of the type of anesthetic used. Shock with Pituitrin has been reported in association with barbiturate,<sup>7</sup> cyclopropane,<sup>2</sup> and spinal<sup>2</sup> anesthesia. In this case, shock occurred after ether anesthesia was used. Death following the use of Pituitrin is most likely to occur just after the patient reacts from anesthesia,<sup>2</sup> as occurred in this instance. In this case, we believe the stage was set for a more severe reaction to Pituitrin by the extreme fear and apprehension of the patient and the anoxia during induction. Changes in heart rate and rhythm are seen during stressful life situations<sup>8</sup> and anoxia is recognized as a potent factor in the production of myocardial depression. Although the possibility of anaphylaxis was considered, the fact that the patient had never previously been given Pituitrin made the likelihood of a sensitivity reaction on an allergic basis very remote.

The extent of the myocardial hemorrhage in this case would appear to support the concept of pituitary-induced coronary vessel constriction. The relationship of mechanical pressure on the heart to the focal areas of myocardial hemorrhage was considered but the extensive involvement of the interventricular septum precludes this mechanism.

### Summary

The case presented is that of a 30-year-old primipara who was extremely apprehensive and was delivered by low forceps under nitrous oxide-oxygen-ether anesthesia. Following partial reaction from anesthesia, the patient was given Pituitrin intramuscularly and went into shock twenty minutes later. Cardiac arrest occurred one hour afterward and attempted resuscitation by means of artificial respiration, cardiac massage, epinephrine, procaine, calcium chloride, adrenal cortical extract, and blood transfusions failed, after two hours of continuous effort.

It is suggested that the routine use of Pituitrin in obstetrics is dangerous. Satisfactory results can be obtained by the use of nonbiological oxytocic preparations, such as the ergot derivatives. In addition, it should be stressed that the avoidance of anoxia by the expert administration of anesthesia in obstetrics is a very desirable goal.

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## PRESENTATION OF FOOT THROUGH INTACT ANUS DURING BREECH DELIVERY

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ONE of the most startling birth injuries that has occurred during my practice was a laceration of the rectum with presentation of a foot through an intact anal sphincter, during the course of an apparently normal breech delivery.

DeLee,<sup>1</sup> in his text, mentions that "there have been cases where the rectovaginal septum gives way over the advancing presenting part, head, arm, or breech, and the latter appears at the anus." A review of the literature reveals several cases. Leroux<sup>2</sup> reports expulsion of a massive ovarian cyst through the rectum, after laceration of the rectum in the course of labor. Yussuf<sup>3</sup> reports rupture of a retrouterine hematocoele into the rectum with passage of a fetus per rectum. In 1934, Hein<sup>4</sup> described in an apparently normal primiparous delivery, the appearance of the anterior leg vaginally, with the posterior leg presenting through the intact anus so that the child was "literally riding on the perineum." Later in the same year, Pohl<sup>5</sup> described an almost identical case. Kassebohm and Schreiber<sup>6</sup> report two cases of delivery complicated by rectal stricture in which rupture of the rectum occurred during the course of delivery. Both of these lacerations were apparently not detected at the time of delivery, and both patients died; in the other cases, recognized and appropriately treated, the patients made uneventful and complete recoveries.

Patel<sup>7</sup> writes of a gravida ii who delivered spontaneously through the rectum, the cervix opening into the rectum. He concluded that the first delivery had also taken place through the rectum. Preston<sup>8</sup> saw a Kikuyu woman who had delivered a stillborn child through the rectum three days previously. The apparent cause for rectal delivery in this case was the presence of massive keloid growths around the vagina resulting from circumcision, and almost obliterating the vaginal orifice. This patient died of sepsis.

Perry<sup>9</sup> reports delivery of a dead fetus, apparently an ectopic pregnancy, through the rectum. The cervix was virginal, and three months later there was fullness in the right fornix which was considered the site of the extrauterine pregnancy. Findley<sup>10</sup> and Young<sup>11</sup> report similar cases, the former describing the protrusion through the anus of first the right hand and arm, then the left hand during the course of a low forceps delivery (left occipitoanterior position). In the latter case, the right foot pushed through the rectal mucosa and appeared through the anus.

It is surprising that except in those cases in which there was previous rectal or vaginal damage, the outcome for the mother was good. The methods of handling the cases varied. Usually, the bridge of anus and perineum was severed prior to completion of delivery of the infant. In one case, the foot appearing at the rectum was pushed into the vagina and delivery accomplished. In some cases the rent, which was clean cut and almost bloodless, was repaired in layers. In others the defect was merely packed. Aftercare varied; in some cases the bowels were moved early; in others the bowels were "locked" for a week.

Mrs. M. S., a white woman, aged 30 years, was first seen in the office on May 10, 1946. The date of the last menstrual period was March 15, 1946. The physical examination revealed a normal healthy white woman. The past history was not significant. There had been one miscarriage on Jan. 13, 1946, at two and one-half months, cause undetermined. The external measurements were normal. It was later determined that a multiple (twin) pregnancy existed. The patient gained 20½ pounds during her pregnancy.

Labor began at 12 A.M. on Dec. 19, 1946. The patient was in the hospital 9 hours prior to delivery, the total length of labor being 11 hours. The first stage was normal for a primiparous labor, the sedation being Nembutal, 1½ gr., and Demerol, 100 mg. Two rectal examinations and no vaginal examinations were performed during the course of labor. After complete dilatation, the breech of a male infant presented in the pelvis, right sacroanterior position. Nitrous oxide and ether anesthesia was administered with pains during the second stage of labor which was 2 hours. A median episiotomy was performed. The labor was progressing normally with no attempt to extract the breech when the left foot presented through the anus, leaving the sphincter intact. The foot was pushed back into the vagina with ease and the infant was thereafter delivered vaginally without difficulty. The second infant soon delivered spontaneously, after rupture of the membranes, in breech presentation, left sacroanterior position. The delivery was rapid and the sphincter was torn with delivery of the second infant, the tear connecting with the initial laceration of the rectum, the whole extending about 3 in. upward. There were 2 placentas, delivered spontaneously in toto (Schultze), one immediately following the other. The first baby weighed 6 pounds, 3½ ounces, the second weighed 6 pounds, 7 ounces.

The rectal mucosa was repaired with continuous plain intestinal suture. The external sphincter and perineum were then repaired in the usual manner with 0 chromic sutures. The patient was given Sulfasuxidine and penicillin post partum. The bowels were moved on the fifth day. The patient made an uneventful postpartum recovery, and returned home on the tenth day. At the time of her 6 weeks examination there was good perineal support and complete healing of the rectum.

This patient has since delivered, spontaneously, an 8 pound, 9 ounce male infant, vertex presentation, 1½ years after the first delivery, and an 8 pound, 4 ounce male infant, vertex presentation, 3 years after this (or 4½ years after the first delivery). Median episiotomy was performed for each of these deliveries with no extension of the incision. The labors were not prolonged.

I can offer no explanation for the laceration into the rectum as the labor seemed to be progressing normally, and the pelvis was ample and soft tissues not unduly rigid. The course of the labor was followed by rectal examinations, and no pathology was noted. The breech presentation could not have caused much undue stretching of the rectal wall. Pohl suggests an unusual friability of the maternal soft tissues due perhaps to a special anlage. He notes, however, that in his case there was no pronounced asthenia, nor was there in the case reported here. Hein suggests a high vaginal laceration which permitted undue pressure on the rectum, but such a laceration was not noted in this case.

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## MERALGIA PARESTHETICA RELATED TO PREGNANCY

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SATTERED throughout the literature are occasional articles on series of cases of meralgia paresthetica. Occurrence of this condition during pregnancy has not, in the past, been pointed out.

Whether the cause is systemic from infection or toxin, or whether it is local, still remains controversial. During the latter half of the gestation period, the patient has a setting of local conditions considered favorable for the development of the disease. To elaborate, the intra-abdominal and intrapelvic conditions could cause trauma to the lateral femoral cutaneous nerve that arises from the dorsal divisions of the second and third lumbar nerves as it courses retroperitoneally across the iliacus muscle. Also tension on the abdominal fascia as the nerve crosses medial to the anterior superior spine of the pelvis after it has passed under the inguinal ligament is possible. Moreover as the "proud-bearing" of pregnancy is more and more accentuated, there is an increasing angulation of the nerve causing further compression.

Probably a combination of these things is, in most cases, the etiological factor; tension or pressure on the nerve that is temporarily more susceptible to trauma by reasons of toxin or infection. In the majority of cases it is unilateral, but can be, rarely, bilateral. It is reported<sup>1</sup> as occurring almost three times as often in men as in women. Schenck<sup>2</sup> feels this condition occurs much more frequently than generally believed.

When the earliest sign, unilateral numbness in the area supplied by the lateral femoral cutaneous nerve, is present, the diagnosis can be easily verified if the examiner is on the alert. So-called "pressure pains" can be blamed if care is not exercised. As Schenck stated, this condition, also known as Roth's or Bernhardt's syndrome, is found incidentally to more debilitating symptoms.

### Case History

E. H., a 30-year-old, white tertigravida, secundipara, at 32 weeks' gestation, presented a complaint of persistent numbness of the anterolateral aspect of the right thigh. The onset was two weeks previously, but she had not reported it as she felt it was not important.

Pregnancy had progressed normally. Blood pressure range was satisfactory. Weight at the onset of symptoms was 131 pounds. The total gestational weight gain was 13 pounds. Further laboratory studies were not significant.

Neurological examination revealed a well-outlined area on the right thigh corresponding to the area supplied by the lateral femoral cutaneous nerve that had diminished pain, tactile, and thermal sense. Deep pressure was preserved. Later the patient stated that she had crawling, tingling and burning sensations, and some moderate pain in the same area. The condition remained unchanged and delivery took place uneventfully, of a 2,714 gram infant. Examination two weeks post partum showed no change in the previous findings. At six weeks post partum the subjective symptoms had changed for the better while the objective findings were present, but less pronounced. At three months examination was negative. At no time did the symptoms create a problem in this patient.

*Comment.*—It is possible that meralgia paresthetica is more common in pregnancy than is generally supposed, as during the gestational period many of the situations which are thought to cause the condition are provided. Complaints such as numbness, burning, tiredness, tingling, and paresthesias are often presented by the gravid patient. It is easy for obstetricians to disregard such symptoms, but they should be evaluated not only from the standpoint of this particular condition, but also because involvement of the lateral femoral cutaneous nerve may be the first sign of neurosyphilis.<sup>1</sup>

Treatment usually is limited to reassurance and general supportive measures such as adequate diet, correction of posture, abdominal support, and curbing undue weight gain. Resection of the involved peripheral nerve has been advocated when symptoms are prolonged or unresponsive to supportive measures.

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1045 NORTH CALIFORNIA

## PREGNANCY FOLLOWING VENA CAVA LIGATION

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SINCE the vena cava was first ligated in 1893 there have been conflicting reports regarding the value of the procedure in thrombophlebitis, the mortality incident to it, and the sequelae secondary to the ligation. In many instances it has been difficult to separate the late swelling, etc., due to the original thrombophlebitis from that due to the vena cava ligation. On the whole, reports have tended to show that the ligation itself does not produce signs of venous stasis in the lower extremities. The value of vena cava ligation in the prevention of emboli is not questioned.

In 1947 we had occasion to ligate the vena cava in two postpartum patients with thrombophlebitis without emboli. Although this was considered by some to be too radical for the condition, both patients are well and free of signs of stasis in the lower extremities. At the time of ligation the question of future pregnancies arose as both were young primiparas. They were advised that the ligation should not interfere with pregnancy and delivery.

Although others must have occurred there are very few cases reported of pregnancy following vena cava ligation. It seemed worth while to report such a case.

Mrs. C. M., white, aged 24 years, was admitted to the hospital April 6, 1947, with a history of having delivered her first child after a 26 hour labor March 20, 1947. There was no apparent postpartum infection and she was discharged on the fifth postpartum day. On the tenth day she awoke with a severe pain in the left groin and was treated at home for several days. On the fifteenth day there were signs of left femoroiliae thrombophlebitis with marked swelling of the entire leg, thigh, and lower abdominal wall. There was tenderness along the course of the femoral vessels extending above the inguinal ligament. She was readmitted to the hospital and operated upon within a few hours. The vena cava was ligated after exploration of the left femoral vein showed it to contain a firm clot.

The patient did well postoperatively and by the fourth day was walking about with Ace bandages and had only moderate pain. Fifteen days after the ligation there was no ankle edema evident although the patient was up only part of the time. A year after ligation there were no signs of lower extremity stasis and no abnormal venous channels had developed. She was carrying on the normal duties of a housewife and taking care of her child. She was advised that she should become pregnant if she so desired.

The patient was seen again Dec. 11, 1950, at which time she stated that her last menstrual period was Oct. 26, 1950.

Physical examination showed her to be in excellent health. There was no evidence of any edema of the extremities and the patient had no complaints. Pelvic examination revealed an early intrauterine pregnancy of approximately four to six weeks' size. Routine laboratory work showed: urinalysis normal, hemoglobin 81 per cent (12.5 Gm.) and red blood count 4.11 million. The blood Kahn test negative, Rh factor positive, and the blood type A.

About the beginning of the fourth month there was slight vaginal bleeding without cramping and this subsided with bed rest, codeine, and dienestrol.

Except for a mild upper respiratory infection four weeks later, the rest of her antepartum course was normal. She was given thyroid extract,  $\frac{1}{2}$  grain twice a day, and ferrous sulfate, 5 grains three times a day. The total weight gain was 10 pounds.

On Aug. 12, 1951, after an uneventful first stage of labor that lasted eight and one-half hours and after being given Demerol, 100 mg., and scopolamine, 1/100 grain, intra-

venously in the last hour of this stage, she delivered spontaneously following a fifteen-minute second stage. Local infiltration (1 per cent procaine) supplemented with nitrous oxide and oxygen inhalations were used for the episiotomy and delivery. A normal-appearing male infant cried immediately. He weighed 5 pounds, 12 ounces. The placenta and membranes separated readily without medication and delivered spontaneously and were found to be complete. There was no abnormal blood loss.

Twenty-four hours after delivery ambulation was allowed.

After an uneventful postpartum stay of six days in the hospital the patient was discharged home. Six weeks later the first postpartum examination revealed normal pelvic findings and she had no complaints. At this time there was no edema of the lower extremities evident. She had been wearing elastic bandages part of the time.

### Summary

1. A case of uncomplicated pregnancy and delivery three years after vena cava ligation for postpartum femoroiliac thrombophlebitis is reported.

2. It would seem from this and other cases reported that ligation of the vena cava does not jeopardize future pregnancies.

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1553 WOODWARD AVENUE

## PREGNANCY FOLLOWING INFERIOR VENA CAVA LIGATION

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DURING recent years it has been recognized that thrombophlebitis is one of the major complications of pregnancy. With this recognition have come numerous methods of treatment (Ace bandages, ligation, anticoagulants, etc.). In several recent publications Collins and associates<sup>1, 2, 3, 4</sup> have called attention to another phase of this problem, namely, pelvic thrombophlebitis. They have advocated inferior vena cava ligation as the procedure of choice.

This, in the young woman who wishes to have children, has raised the question as to the effect on subsequent pregnancies of inferior vena cava ligation. Some investigators feel that there is an increase in the pelvic circulation. Thus, following this procedure, the edema usually associated with pregnancy close to term would be exaggerated, and increased postpartum bleeding might be expected from the pelvic congestion.

A survey of the literature reveals that the only mention of pregnancy following inferior vena cava ligation is that mentioned in the paper by Collins and his co-workers.<sup>3</sup> They reported six pregnancies, among five patients, following vena cava ligation.

Recently a woman pregnant following inferior vena cava ligation, was delivered at the Beth Israel Hospital, Boston, Mass. In view of the paucity of case reports on this subject, and of the increased interest in vena cava ligation, it was felt that report of the case would be of interest.

Mrs. I. R. (No. M12598) was a 42-year-old gravida ii, para 1-0-0-1, who first entered the Beth Isreal Hospital on June 6, 1950, complaining of vaginal bleeding. Her periods were usually regular, every 28 days, lasting 3 days, since the age of 16 years, and the last menstrual period was March 13, 1950. Five days prior to her admission she noted low back pain, abdominal cramps, and she began to bleed per vaginam. This subsided until two days prior to admission when she began to bleed more profusely, continuing up to the time of admission.

*Physical Examination.*—The patient was a rotund, cheerful woman. The breasts had no areolar changes and no colostrum was demonstrated. The heart was not enlarged, the rhythm was regular and there were no murmurs. The abdomen was obese and soft. The liver and spleen were not palpable. There was no costovertebral angle tenderness present. The uterine fundus could be felt two fingerbreadths above the symphysis. The fetal heartbeat was not made out. Pelvic examination revealed a parous introitus with good perineal support. The uterus was anteflexed and 2½ times normal size. The cervix was firm, scarred, and closed. The adnexa were nontender.

*Course.*—A diagnosis of threatened abortion was made and the patient placed on bed rest. On June 18, 1950, she started to bleed more profusely, had cramps, and passed some tissue. A dilatation and curettage were performed. The curettings revealed degenerating decidual and placental tissue. A uterine pack was inserted for 24 hours and the patient given penicillin. The pack was removed on June 9, 1950. On June 10, 1950, her temperature rose to 100° F. and the pulse to 90. She complained of tenderness and heaviness in the left calf and a sticking sensation in the front of the left side of the chest. Examination revealed increased surface temperature of the left leg, pre- and posttibial discoloration, positive Homans' sign, superficial and deep calf tenderness, and tenderness in the popliteal and femoral spaces. Measurements of both legs revealed: right calf 13.5 inches, left calf 14.2 inches; right thigh 19.5 inches and the left thigh 20 inches. A diagnosis of deep throm-

bophlebitis of the left leg was made. Heparin and Dicumerol were started and the leg seemed to improve, except that the Homans' sign persisted, and her temperature continued to be slightly elevated between 99 and 100° F. On June 18, 1950, exacerbation of the signs and symptoms occurred. Pain, heat, and swelling of the left leg increased. The prothrombin time was less than 20 per cent of normal. At 2:00 P.M. on June 22, 1950, she had a mild episode of substernal pain, but there was no cyanosis. X-ray of the chest was negative. The prothrombin time was 13.2 per cent of normal. A spontaneous hematoma (8 cm. in diameter) appeared on the inner surface of the left leg. At 7:00 P.M. she was found clutching her chest, cyanotic and in vascular collapse. The respirations were slow and shallow, the pulse was thready and imperceptible. She was placed in shock position and given oxygen and morphine. She responded well and her blood pressure rose to 130/80. A diagnosis of pulmonary embolism was made. The surgical service was called in consultation and in view of the failure of the anticoagulant therapy, ligation of the inferior vena cava was advised. She was transferred to the surgical service and given 500 mg. of vitamin K<sub>1</sub> oxide and four units of plasma. The clotting time dropped to 10 minutes and an extraperitoneal ligation of the inferior vena cava was performed. The vein was soft, and compressible, and it seemed unwise to explore the iliac vein for thrombosis. Postoperatively, the patient ran an intermittent temperature of 101 to 102° F. for about one week due to a large subcutaneous wound abscess. This was drained and the wound healed well. She was discharged on the twentieth postoperative day.

In November, 1950, she was seen in the Gynecology Outpatient Department because of bleeding. A diagnosis of dysfunctional bleeding was made. The question as to whether there was interference of the pelvic drainage secondary to the vena cava ligation was raised. Cyclic therapy with estrogen was started. Examination on Jan. 9, 1951, revealed the uterus to be slightly enlarged, and it was felt that she was pregnant.

The question of interruption of this pregnancy was raised in view of her thrombo-phlebitic tendency, the inferior vena cava ligation, and the possibility of increased bleeding at the time of delivery. However, as she and her husband were especially anxious to have another child, the pregnancy was allowed to continue.

Her prenatal course was not different from that of the usual patient. She gained only fifteen pounds. She wore Lastex stockings throughout the pregnancy. From the thirty-second to the thirty-seventh weeks, she showed slight edema of both lower extremities.

On Aug. 14, 1951, after 19½ hours of labor, she delivered spontaneously a 7 pound, 3½ ounce living female child. There was no undue bleeding. Her postpartum course was uneventful. She was seen on Jan. 8, 1952, and her condition was excellent, no edema of the lower extremity being noted.

**Comment.**—As was noted in the cases of Collins and associates,<sup>3</sup> the pregnancy ran a normal prenatal course without complications and her delivery was uneventful. Evidences of inadequate collateral circulation, such as edema, cramps, or varicosities, were absent. Thus it would appear from studies of this and other reported cases, that ligation of the inferior vena cava has little or no effect on subsequent pregnancies.

### Summary

A case of pregnancy following inferior vena cava ligation is presented. No evidences of circulatory disturbances as a result of the ligation were noted during this pregnancy.

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## A NEW INSTRUMENT FOR INFANT CIRCUMCISION

HERMAN I. KANTOR, M.D., DALLAS, TEXAS

(From the Department of Obstetrics and Gynecology, Southwestern Medical School of the University of Texas)

SINCE circumcision of the newborn has become almost routine, any instrument which can simplify the operation or add to its safety is welcome. A study of the instruments in current use revealed several drawbacks to their complete acceptance. When the application of a clamp is complicated, the surgeon may not consider it worth while in an operation as simple as circumcision. Moreover, if the instrument makes it difficult to judge the amount of foreskin being excised, and especially if it is possible to remove too much skin or mucous membrane, the surgeon may further challenge its value for him.

In order to construct an instrument which might be more universally acceptable, three principles were kept in mind:

1. There must be the utmost simplicity in its application.
2. The amount of foreskin being removed should be visible and easily gauged.
3. There should be satisfactory hemostasis at the line of circumcision.

To carry out these principles, a hemostat was modified to effect a thin line along its crushing surfaces. At the same time the jaws were changed to permit equal firm pressure along this line. A tooth at the tip of the clamp prevents side slipping. The upper surface was then made flat so that the foreskin might be simply cut with scalpel or scissors. This hemostat was attached to an ordinary circumcision guard. A safety space between the clamp and the guard makes it impossible to injure the glans penis.\*

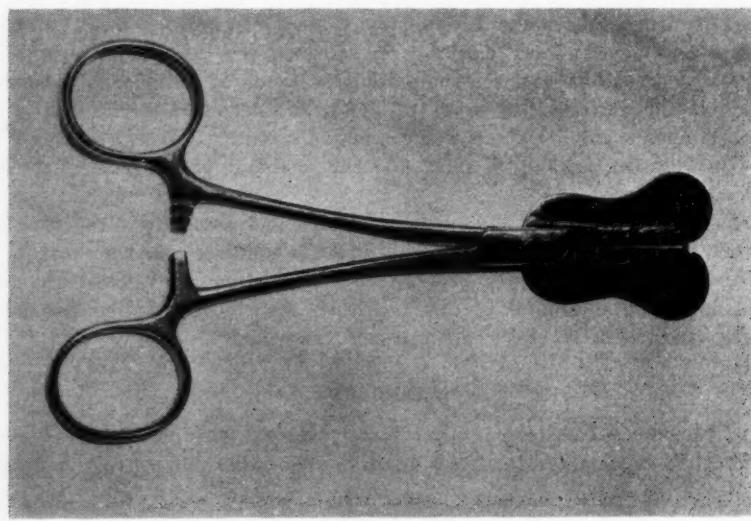


Fig. 1.

The following steps in performing the circumcision are suggested:

1. The foreskin is grasped front and back with small hemostats and pulled forward firmly.

\*This instrument was manufactured with the valuable advice of Mr. E. J. Sovatkin, of the J. Sklar Mfg. Co.

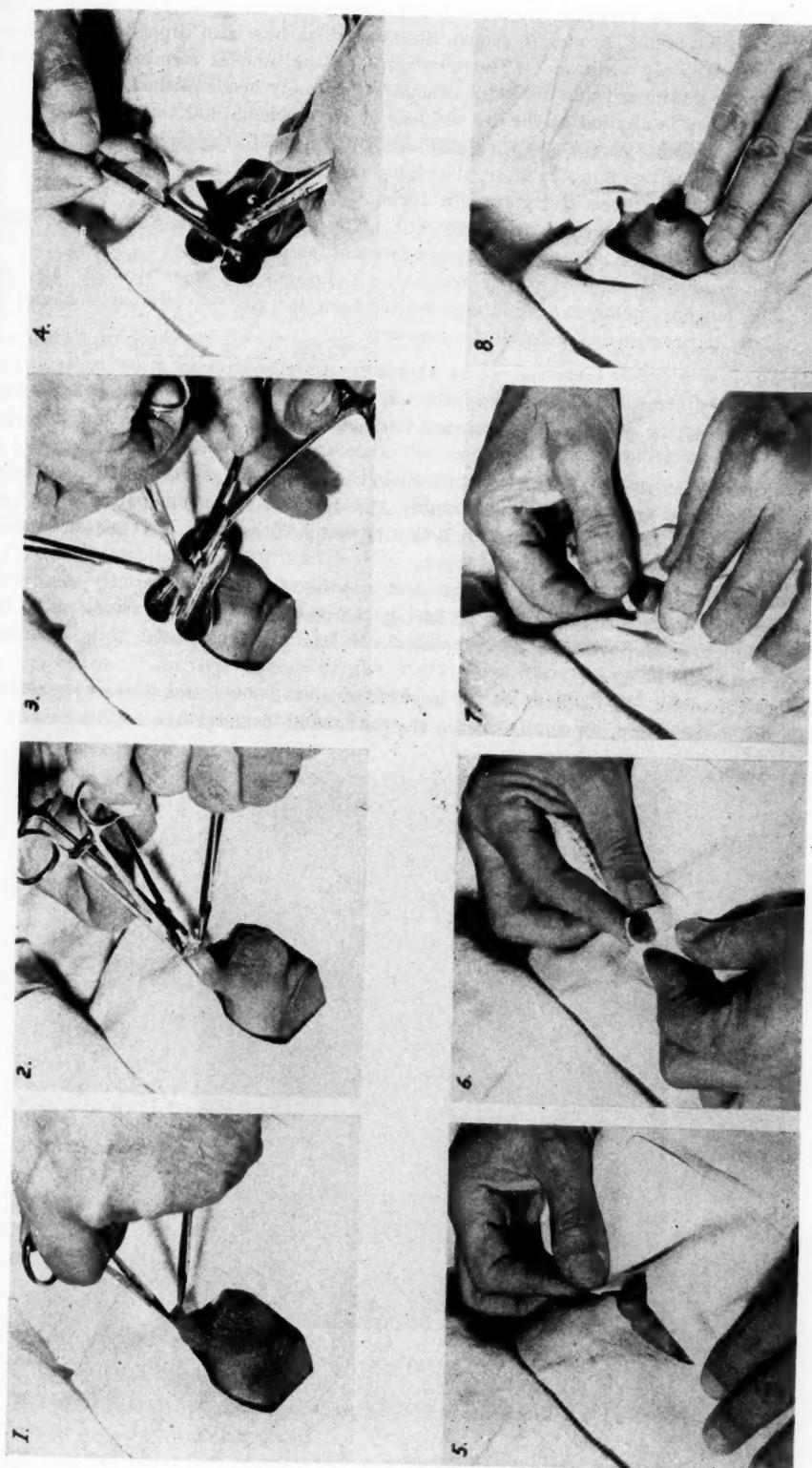


Fig. 2.

2. The adhesions between the mucous membrane and the glans penis are separated with a hemostat, probe, or groove director which has been dipped in petrolatum or sterile soap solution. (The adherence of the mucous membrane to itself is thereby minimized and subsequent separation easily accomplished.)
3. The clamp is applied at the desired line of circumcision and closed.
4. After a minute or two the foreskin is cut off flush with the clamp.
5. After about two minutes more, the clamp is removed.
6. The remaining foreskin is brought forward to loosen it.
7. The foreskin is then gently retracted. The glans penis acts as an obturator, in separating the adherence of mucous membrane to itself.
8. The corona is exposed. Any remaining adhesions are separated at this time. The mucous membrane is interposed between the line of circumcision and the glans to prevent any possible readherence.

Instead of Step 2, some surgeons prefer to retract the foreskin in order to expose the glans penis completely. If this procedure is followed, it is suggested that sterile petrolatum or soap solution be applied to the mucous membrane surface, and the circumcision may then proceed as outlined.

It is important that the retraction of the foreskin in Step 7 be gentle in order to prevent separation between skin and mucous membrane. Bleeding from such separation is infrequently encountered and usually can be controlled with simple pressure. If it seems desirable, the surgeon may easily place a stitch at any point.

When this instrument is used, the circumcision may be completed as rapidly as with any other method. Eight surgeons have used it during the past year in performing more than three hundred circumcisions with excellent results. It has also been used satisfactorily in children up to two years of age.

I am grateful to Dr. W. F. Mengert for his kind encouragement and to the surgeons who cooperated in using the clamp, especially during the changes in its design.

3534 MAPLE AVENUE

## RECEIVING CRIB FOR THE NEWBORN

BERNARD E. CAPPE, M.D., AND IRVING M. PALLIN, M.D., BROOKLYN, N. Y.

LANDAU and co-workers<sup>1</sup> have demonstrated that the newborn at birth may receive by gravity an extra supply of blood from the placenta and cord if the infant is at a lower level than the placenta. In order to take advantage of this placental transfusion conveniently and efficiently, we have had constructed a wooden crib, somewhat in the shape of a Mayo stand, and had it set on casters. The bed of the crib is 24 inches by 16 inches and has a depth of 4 inches and is set at an angle of 15 degrees. It contains a soft, thin, Fiberglas mattress. The maximum height of the crib is 28 inches, which is just 1 inch lower than the level of the obstetrical table. The receiver is draped with a large sterile sheet. When the delivery of the newborn is completed, the receiving crib is rolled into place, the elevated edge of the crib against the caudad edge of the obstetrical table for vaginal deliveries and along the side of the table for cesarean deliveries. The infant is placed in the crib with the head at the lower end. The nasopharynx is suctioned and any other necessary resuscitation is accomplished. The cord is tied and severed when it has ceased pulsating and its vessels have collapsed. The infant thus receives an extra 96 to 107 c.c. of blood.<sup>1, 2, 3</sup> Reynolds<sup>4, 5</sup> has shown in experiments on sheep fetuses that upon inflation of the lungs there is a redistribution of blood as the lung vessels fill up, causing a transient decrease in systemic blood pressure. Effective closure of the ductus arteriosus depends upon adequate systemic blood pressure. The increased blood volume is of value therefore as a means of increasing the cardiac output and blood pressure.

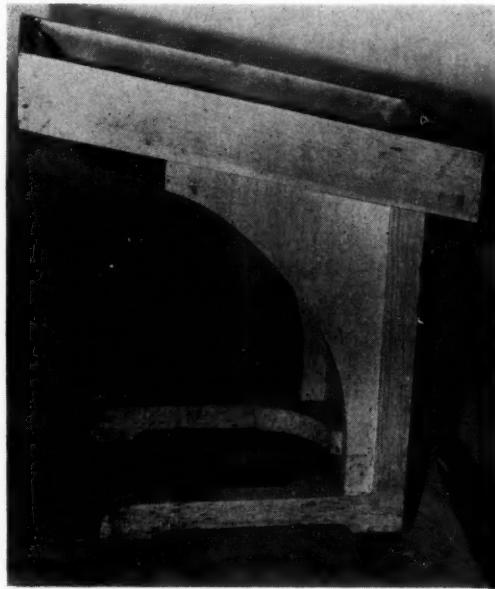


Fig. 1.

The subsequent role of the increased blood volume and the probable increased physiological jaundice remains undetermined.

To sum up, we have presented a receiving crib for the newborn in order conveniently and efficiently to take advantage of the transfusion of an extra 90 to 107 c.c. of placental

blood. The additional blood may be of value in the prevention of neonatal shock,<sup>1</sup> to increase blood volume at the moment when the lung capillary bed is soaking up a great deal of the available blood volume, and as an aid to closure of the ductus arteriosus.<sup>4, 5</sup>

The probably increased physiological jaundice might be a disadvantage.

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# Department of Book Reviews

EDITED BY PHILIP F. WILLIAMS, M.D., PHILADELPHIA, PA.

## Review of New Books

### Obstetrics

This textbook<sup>1</sup> of obstetrical operations is designed primarily for the student and general practitioner. It is a compact and well-organized compendium of obstetrical techniques.

The first portion of the book is devoted to general considerations, including sections upon anesthesia, the mechanism of normal delivery, and the indications for obstetrical procedures. The remainder of the work is devoted to an extremely detailed and profusely illustrated description of the operations for delivery. The proper use of aseptic technique is repeatedly emphasized.

Various obstetrical procedures are described in the minutest detail; for example, 20 pages are devoted to methods of dilatation of the cervix. A similar emphasis is placed upon the technique of breech delivery. Other procedures, such as cesarean section, receive almost equal attention.

The very numerous illustrations are beautifully drawn and illustrate the text with great clarity. They constitute one of the best features of this book.

Some of the concepts in this volume would not be endorsed by many American obstetricians. For example, the marked emphasis upon methods of artificial dilatation of the cervix seems unusual. Hygroscopic cervical dilators are recommended for artificial interruption of pregnancy after the third month. The author feels that forceps may occasionally be applied to the breech. The classical cesarean section is regarded as practically obsolete. The author does not recommend manual removal of the retained placenta until two hours after delivery. Packing of the uterus is recommended in postpartum hemorrhage, being preferred to bimanual compression.

Some procedures which would never be done outside the hospital in this country are regarded as suitable for performance in the home. Among these are Braxton Hicks' version. A procedure for management of rupture of the uterus in the home, for use when hospitalization is not available, is outlined.

Despite these differences of opinion, the book is admirably fitted to its original purpose. However, it seems better adapted for the teaching of obstetricians in a locality where hospitalization is not as readily available as in most parts of the United States.

BRUCE A. HARRIS, JR.

Botella Llusia has prepared a series of four books devoted to elementary courses in obstetrics and gynecology. This one is the third in the series and is a second edition. The other books are *Physiology of the Female*, *Obstetric Pathology* and *Diseases of the Female Genital Tract*. *Tocurgia*<sup>2</sup> or *Surgical Obstetrics* is divided into 12 lessons which deal with analgesia and anesthesia in labor, obstetric hemorrhages, operations for dilating the cervix, forceps operations (3 lessons), destructive operations (2 lessons), breech extraction, version, and cesarean section (2 lessons).

The book reflects the author's wide experience as an obstetrician, a teacher, and an investigator. The book is well written and it contains a large number of instructive illustrations. The teachings are in accordance with those of conservative obstetricians through-

<sup>1</sup>*Geburtshilfliche Operationslehre*. By Prof. Karl Burger. Director of the University Woman's Clinic at Würzburg, Germany. 278 pages with 227 illustrations. Berlin, 1952. Springer-Verlag, DM 39.

<sup>2</sup>*Tocurgia*. By Jose Botella Llusia, Professor of Gynecology, Faculty of Medicine of Madrid. Second edition, 200 pages with 146 illustrations. Barcelona, 1952, Editorial Clínico Médica.

out the world. The author describes and illustrates his modification of the extraperitoneal cesarean section. A minor criticism is that too much space is devoted to destructive operations (22 out of the 200 pages and 19 of the 146 illustrations). Without doubt this edition, which has been considerably improved, will be as popular as Botella Llusia's other books.

J. P. GREENHILL.

The author starts his monograph, *The Transfusion of Preserved Blood in Obstetrics and Gynecology*,<sup>3</sup> with the interesting history of the blood transfusion as far back as 1556, when Robert Lower made the first transfusion in animals. In 1667 James Dennis, in France, and, in the same year, Kind and Lower, in England, transfused animal blood to human beings for the first time. In 1700 blood transfusions were prohibited because of their failure. James Blundell (London), a physiologist and obstetrician used, for the first time, human blood for the transfusion in 1885. However, blood transfusions were still a big risk until, in 1900, Langsteiner discovered the blood groups and in 1914 Hustin (Belgium) and Levinsohn (New York) added sodium citrate to the blood in order to prevent coagulation.

The indications for blood transfusions in obstetrics and gynecology are thoroughly discussed and the complications due to negligence in regard to the Rh factor are explained. The advantage and disadvantage of blood obtained from the umbilical cord of the newborn infant are discussed. A special chapter is devoted to the organization of donors. The installation of a blood bank depends largely on the technique of keeping the blood in good condition for a certain time. Changes of the cells and the process of hemolysis is discussed in detail.

The difference in the technique of blood transfusion for adults and for newborn babies is described. The effect of the transfused blood in the patient is shown in reference to the amount, the venous pressure, the blood chemistry, the hemostasis, and the influence upon the bone marrow. Accidents connected with the blood transfusions, their causes and prevention, are pointed out. The use of plasma and serum is discussed and a chapter about the application of a suspension of erythrocytes concludes this valuable book which will certainly be of interest to doctors and students who understand the German language.

ROBERT TAUBER.

The increasing importance of the care of the newborn infant both to the pediatrician and the obstetrician has prompted the publication of this book, *Management of the Newborn*.<sup>4</sup>

The author has drawn on his extensive clinical experience, and has compiled a volume rich in practical aids to the less experienced. This book is not written for those interested in clinical investigation and, indeed, those sections dealing with the physiology of the fetus and newborn infant could better have been omitted.

Another limitation of the work is that it represents one man's opinions, and conflicting opinions, such as those relating to hemorrhagic disease, hyaline membranes, and treatment of cerebral hemorrhage are barely mentioned.

The sections on the characteristics of the newborn and the premature infant are excellent, complete, and contain many clinical pearls. Unfortunately, in the mention of anemias, the reader is left with the feeling of having read a chess book of "openings," with no details of the "middle game." However, the author makes no pretensions at going beyond the immediate neonatal period, and the description of this age period could well serve as a standard in physical diagnosis.

Without doubt, the section entitled "Asphyxia," relating to resuscitation of the newborn infant, will be found most valuable to obstetricians and pediatricians alike, and should be studied by them.

<sup>3</sup>Die Transfusion von konserviertem Blut in der Geburtshilfe und Gynaekologie. By Prof. Dr. H. Schwalm, Marburg/L. 132 pages, with 21 illustrations. Stuttgart, 1952, Georg Thieme Verlag, DM 14.70.

<sup>4</sup>Management of the Newborn. By Arthur Hawley Parmelee, M.D., Professor of Pediatrics, University of Southern California School of Medicine. 368 pages with 47 illustrations. Chicago. 1952 Year Book Publishers, Inc. \$7.00

The book concludes with brief mention of the common congenital malformations and neonatal infections.

This book is recommended especially to interns and residents in pediatrics and obstetrics.

PAUL GYÖRGY.

### Gynecology

The authors of **The Menopause**<sup>5</sup> are to be commended for presenting a useful and interesting book on an important subject. Dr. Levine is a gynecologist and psychiatrist, Chief of the Gynecological Hygiene Clinic, Jewish Hospital, Brooklyn, N. Y. Beka Doherty is a journalist specializing in science and medicine. The contents include: (1) What Is the Menopause? (2) What Is Woman? (3) What Really Happens? (4) What Can Be Done? (5) What of the Future?

An excellent summation of the viewpoint expressed is seen in the statement, "Although it is perfectly true that the menopause is an important event in a woman's life, and will continue to be important as long as there are women, its importance need not continue to be negative. Rather, men and women both must understand its real nature as the end of a function—a phenomenon occurring in the lifetime of a woman. Most other functions continue from the beginning of life until its end. The menopause is simply an event marking a change—the climax to the longest phase of a woman's life—not a tragic affliction nor a hopelessly desexing mark of age."

The psychological aspects of the menopause, so widely misunderstood, are treated simply but authoritatively and emphasized by brief case reports. The book should find a useful place in the doctor's library, particularly among those physicians who desire to be brought up to date in recent psychological thought pertaining to the subject. As a book to be read by an intelligent laity it can be recommended without reservation.

HERBERT THOMS.

The **Atlas of Gynecologic Pathology**<sup>6</sup> is an ingenious idea designed to further the teaching of gynecological pathology. It consists of 100 two-inch Kodachrome slides with a small manual which contains an index of the slides, a brief summary of the various diseases covered, and most particularly an orientation and description of each slide. The slides and manual are conveniently and attractively packaged together and the slide mounts are of the excellent aluminum "Snap-It" variety.

Furnished for review was the descriptive manual and two sample slides only. Considering the necessary price of this publication, such a circumstance could impose a certain hardship upon any reviewer who might wish to write a complete review. In this instance, out of natural interest in the subject, the complete collection was purchased and, using a good projector, was viewed repeatedly with colleagues before this review was written. A good projector, incidentally, is a necessity for getting the most out of any two-inch material. The slides may be shown and the descriptive manual read in something over three hours.

The selection of specimens is generally good. The photography is of surprisingly uniform good quality considering the large number of slides made and reproduced. It is certain that purchase of the **Atlas** will satisfy the "collecting" instinct that most men soon develop as they start to review pathology. However, the authors will agree that neither this, nor any other collection of slides makes a pathologist. A certain amount of preliminary work with the microscope will always be necessary. In our specialty also the man must learn something more about the anatomy, histology, and pathology of pregnancy than is possible from the present collection.

<sup>5</sup>**The Menopause.** By Lena Levine, M.D., Chief of Gynecological Hygiene Clinic, Jewish Hospital, Brooklyn, and Beka Doherty. 198 pages, New York, 1952, Random House. \$2.75.

<sup>6</sup>**Atlas of Gynecologic Pathology.** By Anthony V. Postoloff, M.D., Pathologist and Director of Laboratories, Millard Fillmore Hospital, Buffalo, N. Y., Associate in Pathology, University of Buffalo School of Medicine, and Captain David H. Nichols, M.D., Medical Corps, United States Air Force, Formerly Chief Resident Obstetrician-Gynecologist, Millard Fillmore Hospital, Buffalo, N. Y. 74 pages with 100 slides, Baltimore, 1952. The Williams and Wilkins Company. Price \$8.00, slides included.

In the interest of conservative gynecology, it is probable, too, that students should not attempt to learn surgical treatment from this book. For instance, a cervical polyp is shown which was treated by total hysterectomy. In addition, certain advanced carcinomas of the cervix are photographed from specimens which, from the standpoint of conservatism, might better have been photographed through a speculum.

All in all, however, the *Atlas* is an entertaining visual adjunct to the teaching of gynecological pathology. It should be of use wherever study groups are rounding off their instruction, and it is predicted the idea will be taken up by other branches of special pathology.

ROBERT L. FAULKNER.

The literature relative to the inheritance of factors disposing toward the development of cancer in the human being is sparse. The earliest work appeared in 1908. However, the greatest number of studies has been reported in the past fifteen years and includes about a dozen contributions. Of these, only one, that of Brøbeck, entitled *Heredity in Cancer Uteri*,<sup>7</sup> published by the Danish University Press in 1949, is pertinent to the present investigation. However, this study left much to be desired, at least theoretically, because the control group consisted largely of patients who had been previously studied for leukemia. It did serve to give an indication of the incidence of cancer in the general population.

It is important, for many reasons, to determine whether heredity plays a role in the etiology of human cancer, and, if so, whether it is a significant one. As information has been made so readily available to the layman on the incidence, location, and symptoms of early cancers, it would be humanitarian also to advise him as to what the chances of developing cancer really are, particularly if there has been cancer in the family tree. At any rate, those studying the cancer problem should be advised of the magnitude of their task.

To achieve this information, Murphy and his associates chose for study the relatives of 201 women who had suffered from cancer of the uterine cervix, and 215 controls selected from the population, without known previous malignant disease. This composed a group of 6,445 individuals.

The rules followed in the study, the questionnaires, the assisting personnel and their instructions, and the accumulation and sorting of data seem to have been done with admirable foresight and thoroughness. The correlation and interpretation of the data were criticized and assisted by representatives from outstanding institutions versed in problems involving biometrics. One can, therefore, for the first time—thanks to Dr. Murphy—make accurate statements regarding the inheritance of uterine cancer. Although the material is highly technical, the writer has the gift of simplifying the ramifications of statistical complications into readable English.

The author draws the following conclusions: For statistical purposes cancer of the cervix and that of the fundus cannot be separated, and taking the two together heredity does play a factor as first generation relatives show an incidence of 3.2 per cent, as contrasted to only 1.4 per cent of the mothers and aunts in the control group. Relatively, the former is twice that of the latter.

The incidence of cancer of the breast shows no evidence of being linked to the incidence of cancer of the uterus.

The incidence of cancer of the uterus was not found to be associated with an unusually high incidence of cancer in other parts of the body. The incidence of cancer in the control group was 6.4 per cent, whereas, in the relatives of the cancer patients it was 5.6 per cent. This leads to the important conclusion that the genetic factors which predispose toward the production of uterine cancer are specific, and do not dispose, so far as can be determined, toward the production of cancer in other sites. Finally, the study indicates that hereditary factors, other than those pertaining to uterine cancer, play a role in the etiology of cancer in other parts of the body.

<sup>7</sup>**Heredity in Uterine Cancer.** By Douglas P. Murphy, M.D., F.A.C.S.. Assistant Professor of Obstetrics and Gynecology, Research Associate, Gynecologic Hospital, Institute of Gynecologic Research, University of Pennsylvania. 128 pages, 56 tables, Massachusetts, 1952, Harvard University Press, \$2.50.

The reviewer is impressed with the value of this contribution, and the scientific methods employed, as well as the readable manner in which it is presented.

HERBERT F. TRAUT.

**Fluid Balance: A Clinical Manual**<sup>8</sup> is exactly what its title declares, and an excellent manual it is. The emphasis is primarily upon the clinical recognition and treatment of the various types of water and electrolyte disturbances commonly encountered. To this end the author presents a number of illustrative cases and for each one tabulates the relevant clinical and laboratory findings. From these tables, which are the outstanding feature of the book, the differential diagnosis and indicated therapy become clearly evident.

There are good discussions of the shortcomings of the individual criteria for the recognition of the different fluid imbalances, and of acidosis and alkalosis in their essential independence of the CO<sub>2</sub> combining power.

While a little short on the physiologic aspects of the problem, the author does give enough of the basic knowledge to clarify the rationale of treatment. This is, of course, the purpose of the book.

The complications of parenteral fluid therapy are discussed in the final chapter and a much-needed word is said about "pernicious routines." Some of the unphysiologic aspects and undesirable effects of so-called physiologic saline are mentioned.

Conventionally, a reviewer takes the attitude of a schoolmaster and points out minor slips and printer's errors. This I shall omit, except to note a misprint on page 76 in which the plasma chlorides are characterized as "only traces present" in water intoxication. The phrase obviously is repeated from the characterization of the urine, a few lines above. For one who has spent his professional life in a maternity hospital, the phrase "lactated Ringer's solution" evokes an irreverent picture of its source.

While the body does have some defenses against intravenous injections, they can be overwhelmed by injudicious "therapy." This valuable manual is recommended for study by anyone treating patients with water and electrolytes.

LEON C. CHESLEY.

This text, **Gestation et Cytologie Vaginale**,<sup>9</sup> presents the various known facts concerning normal and abnormal pregnancy, abortion, and the other disorders common to pregnancy, in a concise, easily readable form. The authors have described in detail the many cytologic manifestations of normal pregnancy, abnormal pregnancy, abortion, and the postpartum stage. They have presented their material in a logical, scientific manner, correlating their hormonal studies with the cytologic findings.

Of great practical importance are their conclusions about the acidophilic and pyknotic indices in pregnancy before and after the three months' stage. The difficulties connected with the smear test for early pregnancy are described in a clear, distinct manner. Their observations of the rise in the cornification where threatened abortion develops and the value of follow-up cytologic examinations in pregnancy in general are of practical value, indicating the role of the vaginal smear as a guide to successful hormonal therapy in habitual abortion. At the end of the book, the importance of cytology in the detection of rupture of the membranes and the problems of cancer diagnosis in pregnancy are described.

The work is written in very easily understandable French, is illustrated with good photomicrographs (some colored) and figures, and a detailed list of the complete literature available is placed at the end of the book.

We congratulate the authors on their fine work which presents many original ideas and think it of great value to appreciate and understand the difficult new field of obstetrical cytology. The book is of practical value to the obstetrician interested in cytology and endocrinology and emphasizes the practical advisability of cytology in the follow-up on obstetrical patients.

B. C. HOPMAN.

<sup>8</sup>**Fluid Balance: A Clinical Manual.** By Carl A. Moyer, M.D., Professor of Surgery, Washington University School of Medicine, St. Louis. 191 pages, with 20 tables, 3 photographs and 2 figures. Chicago, 1952, Year Book Publishers, Inc. \$3.75.

<sup>9</sup>**Gestation et Cytologie Vaginale.** By J. Paul Pundel, Agrégré de l'Enseignement Supérieur, and Fred Van Meensel, La Clinique Universitaire Brugmann. 209 pages with 80 illustrations. Paris, 1951, Masson et Cie.

The study of sterility of tubal origin is considered by Bunster, in agreement with practically all other workers in this field, to be of major importance in sterility. In this large volume,<sup>10</sup> the author reviews the historic development of our knowledge of the oviducts from the time of Fallopius, their discoverer, to the present time. The anatomy, including histological changes and physiological aspects, particularly, is given much space. The classic methods of testing for tubal patency and nonpatency are described with great accuracy and detail. The surgical treatment of obstructed tubes receives painstaking and meticulous consideration. The illustrations (all done in black and white) with numerous hysterosalpingograms must make the text intelligible, even to the reader who is unfamiliar with the Spanish language.

In view of the large scope of the rapidly expanding knowledge in the field of sterility, with its extensive literature which the author has thoroughly digested despite the difficulties imposed by differences in language, he has succeeded admirably in presenting the salient data pertinent to tubal sterility. The world literature on this topic covering some 733 references should serve to convey some idea of the labor that has gone into this book.

The reviewer cannot fail to note the pardonable pride with which the author has singled out fellow South Americans for special distinction as pioneers in the use of Lipiodol in hysterosalpingography and in the interpretations of the oscillations observed in kymographic uterotubal insufflation.

Bunster's own contribution, in the reviewer's opinion, has considerable merit. There is still much room for differences of opinion, as of interpretation in the academic and theoretic scientific phases of tubal physiology and in the physical and biodynamic aspects of uterotubal insufflation. Any honest and sincere effort such as has been made by Bunster is commendable. Having collated the facts pertinent to tubal sterility, the author reports the results of his own experience which even the informed specialist in sterility will find rewarding reading.

I. C. RUBIN.

In his study, *The Influence of the Nervous System Upon the Anatomy and Physiology of the Human Sex Organs*,<sup>11</sup> the author reviews briefly the relation of ovarian function and endometrial changes, and explains the influence of the psychic trauma upon the female sex organs in the childbearing age. Frequently he found, in autopsies of air raid victims, marked changes in the follicles. The endometrium was in the resting stage and almost atrophic. Many interesting pathologic conditions following a psychic trauma are thoroughly analyzed and discussed, as, for instance, a silent ovulation. This is called an ovulation without changes in the endometrium and without menstruation. Uterine bleeding caused by fear and fright may occur at any day of the intermenstrual phase and generally does not interfere with the normal cycle afterward. Reactions of the oocytes originating in ovaries which are damaged by a psychic trauma are discussed in detail. The author frequently defends his theories, which are not generally recognized, probably because certain autopsy findings and the history of the psychic trauma are not accepted as satisfactory basis for physiologic changes. Nevertheless, the reader who understands the German language might find many chapters interesting even if he will not agree with the author in all details.

ROBERT TAUBER.

#### Miscellaneous

**Hippocrates on Intercourse and Pregnancy**,<sup>12</sup> an English translation of *On Semen* and *On the Development of the Child* from the Hippocratic Corpus, which Singer has attributed to a writer of the Fourth Century B.C., is, as Dr. Alan Guttmacher states in his introduction, of great interest to the biologist, the student of philosophy, and the physician. Presumably using Littré's monumental work as his source, Dr. Ellinger has made this treatise on generation, which may be regarded as an authoritative compilation of the theories then held of reproduction, embryology, and heredity, available for the first time to the general reader.

<sup>10</sup>**Trompa de Falopio y Esterilidad de Causa Tubaria.** By Eduardo Bunster, Medico-Jefe de la Sección del Hospital El Salvador, Santiago, Chile. 549 pages with 315 illustrations. Buenos Aires, 1951, Guillermo Kraft, Ltda.

<sup>11</sup>**Der Einfluss des Nervensystems auf Bau und Tätigkeit der Geschlechtsorgane des Menschen.** By Prof. Dr. med. et phil. H. Stieve. 191 pages, with 93 illustrations. Stuttgart, 1952, Georg Thieme, DM 36.00.

<sup>12</sup>**Hippocrates on Intercourse and Pregnancy.** By Tage U. H. Ellinger, Sc.D., M.A., Professor of Zoology and Genetics at the University of the Philippines. 128 pages. New York, 1952, Henry Schuman, Inc. \$2.50.

After dissociating themselves from the idea that disease and other natural phenomena were attributable to divine influence or other fantastic imaginations, the Greeks were forced to formulate replacement theories. This work expounds such a theory and marshals the arguments in its favor. While from the vantage point of our present knowledge the theory is inadequate, it was, nevertheless, a beginning. In an age when midwives officiated at most deliveries and human dissections were unknown, the author attempts to draw commendable, although oftentimes inaccurate, analogies from the vegetable kingdom and lower animal life.

Although Hippocratic medicine has been most famous for its accuracy of observation, this work bespeaks more of the armchair type of philosophy with the inevitable post hoc fallacies. At the same time the accusation that the ancients failed to utilize experimentation to bolster their theories is refuted by the excellent instructions for observing the development of the chick embryo—an experiment that was actually carried out centuries before by the Egyptians.

Of especial interest to the reviewer was this ancient author's advancement of the pangenesis hypothesis which was destined to remain dormant for over two thousand years until it was restated by Charles Darwin. The translator's appreciation of this fact and his insertion of Darwin's reply to Dr. William Ogle, who brought the Hippocratic philosopher to Darwin's attention, makes an interesting footnote to medical history.

EDWIN M. JAMESON.

**A Sex Guide to Happy Marriage**<sup>13</sup> has the ripeness and adequacy that should come from the long counseling experience of the author and repeated rewriting of the text. One can hardly think of a subject or problem that isn't there as a chapter or paragraph. There are good sections on behavior of the engaged couple, preparation for marriage, and the honeymoon. "Some Male Problems" is the title of a helpful chapter. Sterility and its treatment are well explained for the layman.

An outstanding characteristic of the book is the author's sensitive awareness of religious motivation in people. He recognizes and tries to help people find the rich spiritual values in the sex side of life. There is emphasis on the importance of achieving not only physical satisfaction and emotional comfort and release, but also "sex communion."

Planned parenthood is thoroughly treated and is advised from the beginning of marriage. While recognizing freedom of choice for the woman or couple, he clearly advises preparation for coitus (dilatation if necessary) and fitting before marriage with a "barrier device" to be used with a spermicidal jelly.

For those who do not have their own private doctor, the Planned Parenthood Clinic Services are listed with addresses in 43 states or territories, the list filling 18 pages. Fertility services listed fill 6 pages. Seven pages list the member agencies of the Family Service Association of America. Finally, 35 Marriage Counseling Services in 13 states are listed. This directory is complete at the moment, and should be helpful to readers while or where the available physicians are not equipped as the author thinks they should be.

This reviewer finds nothing of importance to criticize, and considers the book one of the best.

LOVETT DEWEES.

**Grundlagen der Strahlentherapie**<sup>14</sup> is divided into two parts. Part I deals with the physics of x-ray and radium and Part II with the biology of radiation and treatment with x-rays and radium.

The author explains the nature, the production of radiation dosage, and various methods of x-ray therapy. He also discusses at length the effect of radioactivity, both natural and artificial, and, finally, the effect of radiation on the cells and tissues of the body.

<sup>13</sup>**A Sex Guide to Happy Marriage.** By Edward F. Griffith, M.R.C.S., L.R.C.P., Psychologist to the Middlesex Hospital, London, Founder-member of, and Consultant to the British Marriage Guidance Council. 352 pages with 19 illustrations. New York, 1952, Emerson Books, Inc. \$3.00

<sup>14</sup>**Grundlagen der Strahlentherapie (Principles of Irradiation Therapy).** By Richard Kurt Kepp, M.D., Apl. Professor of Obstetrics and Gynecology, University of Göttingen. 357 pages with 134 illustrations. Stuttgart, 1952, Georg Thieme, DM 38.

The book is generously illustrated with excellent graphs and photographs. The subject matter is clearly presented, especially the determination of isodoses for various radium applicators, including the radium canon, and the determination of depth dosage and tumor dosage with all ranges of x-ray, plus the 6 and 15 megacycle betatron.

For the student and physician interested in the treatment of malignant disease with radium, radioactive substances, and x-ray, the book is extremely valuable. Its translation into English would be a definite contribution for those not familiar with the German language.

HERBERT E. SCHMITZ.

This book, *The Thyroid*,<sup>15</sup> is not just another monograph on the subject. It is really a treatise, one which should prove of great aid to the physician and surgeon interested in this particular subject. The author, Dr. Thomas Hodge McGavack, quite thoroughly covers the questions of anatomy and physiology of the gland, its pathology, and the treatment of the various types of goiter. The whole matter of the newer antithyroid compounds and radioactive isotopes is well treated. The same is true of other fundamental phases of the thyroid problem. Each chapter is followed by an especially complete table of references.

In this day, with the rapid changes taking place in our knowledge of thyroid physiology and especially the therapy of goiter, one must possess courage founded on a thorough study of the field coupled with a broad personal experience with the problem and its countless ramifications to attempt another work on the thyroid gland, its diseases and their treatment. There have been a number of excellent monographs on the thyroid in recent years—by Hertzler, by Joll of England, Means of Boston, Arnold Jackson of Wisconsin and, more recently, by George Crile, Jr. These have all been well prepared; one or two are almost classic. McGavack's new publication is timely and now brings us up to date.

The section on surgical treatment of goiter has been prepared by Dr. James M. Winfield and Dr. Walter L. Mersheimer, also of New York Medical College. A section on history has been added by Dorothy B. Spear, Ph.B., Librarian, with the assistance of Dr. McGavack.

The subject of metabolism of iodine is well covered as is that of the nature and physiology of thyroxin. The book is well but not profusely illustrated—largely with graphs and tables. There are also a few photographs of patients and roentgenograms. As mentioned, the references are especially complete. This work would be of value for its extensive bibliographic tables if for nothing else, but it also possesses many other qualities recommending it to the student of the thyroid gland. The older monographs naturally made no reference to antigoiter drugs nor to the isotopes of iodine and their application in the treatment of hyperthyroidism, so one turns with special interest to the chapter dealing with this newer therapy. One finds the question of thiouracil and its more recent derivatives and their application in toxemia of hyperthyroidism adequately covered. The subject of radioactive iodine and the use of I<sup>131</sup> in the treatment of hyperthyroidism, with several pages dealing with methods of determining roentgen equivalents, are all interestingly handled briefly, but in an informative and practical manner. Other "antithyrotoxic" agents are referred to with their relative therapeutic importance discussed. Ophthalmopathic Graves' disease is considered quite completely in a chapter devoted solely to this subject.

A purist might object to certain expressions. Some might shy at "the condition leading to toxicity" when a toxic state or condition or a condition of toxemia is meant. Or, again, "there having been evidences of previous pathology"—a chronic offender in much medical writing. However, the book is so well arranged, the various subjects so completely discussed and the work, taken as a whole, of such general excellence that minor matters of construction may be overlooked.

As an example of the bookmaker's, printer's, and binder's arts, this work is on the highest plane. It is a book that anyone interested in the treatment of diseases related to the thyroid cannot afford to be without—a trite statement, routinely used by reviewers, but made, in this instance, with complete sincerity.

HAROLD L. FOSS.

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<sup>15</sup>*The Thyroid*. By Thomas Hodge McGavack, M.D., Professor of Clinical Medicine, New York Medical School. 646 pages with 76 illustrations. St. Louis, 1951, The C. V. Mosby Company. \$13.50

## Correspondence

### Postural Shock in Pregnancy

To the Editor:

I had the great pleasure of reading in Vol. 62, No. 3, of your JOURNAL an article written by Dr. William A. McRoberts, Jr., entitled "Postural Shock in Pregnancy."

I am writing to you because this interesting communication supports some observations that I made in 1950 while at the Maternidade-Escola (Rio) about the same phenomenon, namely, the influence that the dorsal recumbent posture has in causing circulatory perturbations in late pregnancy.

The result of my observations was published in the *Archivos brasileiros de medicina*, No. 11-12 of 1950. I am taking the liberty of sending you a copy of the publication referred to.

I did not investigate the syndrome during labor as did Dr. McRoberts, but rather in the last two months of pregnancy. I had five cases in which postural shock was produced every time the patient assumed the dorsal recumbent posture. The time necessary to effect the shock varied in each case. But in all the patients I was able to follow the fall in blood pressure progressively, taking the readings and the pulse rate every minute, which permitted verification also of the fact that there is always an initial phase of tachycardia followed by bradycardia. Only one of the five patients, in whom the vasomotor collapse was initiated rapidly, lost consciousness during one of the tests to which she was submitted, regaining it again immediately upon changing position. The others refused to cooperate and turned to the side when the blood pressure reached the critical level (below 50 mm. Hg for the systolic pressure).

The symptoms were identical with those described by the author: general discomfort, pallor, perspiration, numbness, shortness of breath, and vague sensations referred to the epigastrium.

After delivery none of these patients manifested the syndrome and the dorsal recumbent posture ceased to exercise any influence on the blood pressure and on the pulse rate.

I am not wholly in agreement with the author when he says: "These postural changes are apparently due to the obstruction of venous return from the pelvis and the lower extremities by the pressure of the gravid uterus."

I think that the syndrome is dependent on a reflex produced by the stimulation of the nervous structures situated behind the uterus. The stimulation would be given by the fetal compression in the dorsal recumbent posture. Such an interpretation has in its favor certain facts which we can observe. To name a few:

1. Meals exercise a clear influence over the syndrome. During the digestive period, the postural shock is not generally obtained.

2. Bringing on the postural shock experimentally two or three times consecutively shows that the shock is more easily obtained the first time. The second time, there is a retardation in fall of the blood pressure, indicating probably the fatigue of the reflex and the need of a more powerful stimulant.

3. Atropine administered in a dose of 1.5 mg. parenterally is capable of impeding the blood pressure drop and, given in a smaller dose, retards or weakens the postural shock.

4. The patients who manifested the syndrome while they were lying on the side showed a difference of blood pressure in the two arms, the one which was up showing lesser arterial pressure, regardless of the left or right lateral position.

5. Finally the infiltration of the solar plexus with a solution of Novocain suppresses the syndrome temporarily.

These facts and some analogies between this syndrome and the solar reflex<sup>1, 2</sup> lead me to the supposition that postural shock or vasomotor collapse is probably produced by a sympathetic reflex. The Aschner-Danini test that I performed in three groups of patients apparently supports this hypothesis because in vagotonic pregnant women the dorsal recumbent position did not appear to exert any appreciable influence on the blood pressure or pulse rate.

The action of atropine is difficult to explain.

I agree that the problem merits ample and extensive investigation.

JOFFRE MARCONDES DE REZENDE, M.D.

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2. Claude, H., Garrelon, L., et Santenoise, D.: J. de physiol. et de path. gen, 22: 858, 1924.

RUA GENERAL OSÓRIO, S/Nº  
BELA VISTA, MATO GROSSO, BRASIL  
MAY 5, 1952

### Delivery Following Apparently Healed Genital Tuberculosis

To the Editor:

Since we have received a number of requests for information regarding the further progress of a case reported in this JOURNAL for October, 1950, entitled "Tuberculosis of Endometrium and of Cervix Associated With Pregnancy. Successful Treatment With Streptomycin," we wish to submit here a résumé of the progress of the case since that time.

The case was that of a young white primigravida in whom a diagnosis of tuberculosis of the endometrium was made shortly after the delivery of a premature infant who died of aspiration tuberculosis. The mother was treated with streptomycin with apparent success at the time of our first report. Since that time the patient has been followed regularly.

In January, 1950, pelvic examination revealed nothing unusual.

In July, 1950, chest x-ray was negative, menstrual history normal. Cultures taken from the endocervix at this time were negative for tuberculosis.

On Oct. 14, 1950, the history was negative, pelvic examination normal. Curettage was done for check. Tissue was cultured and a guinea pig inoculated with the material, and both were negative to tuberculosis.

During this interval temperature charts and careful observation by physician husband revealed no clinical evidence of tuberculosis infection. After consultation with the patient and her husband and a discussion of the risk involved, it was decided to let her attempt another pregnancy, which resulted as follows: The last menstrual period was Jan. 14, 1951. She had routine care, no specific therapy, a normal antepartal course with no fever or abnormal findings indicative of tuberculosis of the pelvis or elsewhere. This care included cervical cultures taken February 22, March 15, April 6, July 20, and August 24, all of which were negative for tuberculosis, and a guinea pig inoculation with cervical material of September 21, which was negative for tuberculosis. Delivery was Oct. 28, 1951, by low forceps and episiotomy, with ethylene anesthesia after an uneventful six-hour labor. Recovery was afebrile and uneventful. The baby survived and careful pediatric follow-up to this date reveals no evidence of tuberculosis. Smears and cultures were taken from the cervix when labor first started, and smears, cultures, and material for guinea pig inoculation taken from the amniotic fluid prior to delivery were negative, as were smears and guinea pig inoculation from the baby's nose and mouth before the first breath. Cultures from the cord blood and from the lochia two and three days after delivery were negative. The placenta was carefully examined and showed no evidence of tuberculosis. Neither baby nor mother was given specific therapy (streptomycin) postpartally. On Dec. 21, 1951 (at the six weeks post partum examination), the pelvis was normal. Culture taken Feb. 22, 1952, was reported negative. Examination April 1, 1952, showed the pelvis normal, and the menstrual history

was normal. Culture at this time was negative. Chest x-ray was negative, and the clinical history gave no evidence of tuberculosis infection. This patient is to be followed at six-month intervals but all indications at present are that the streptomycin therapy was successful.

JOHN S. HERRING, M.D.

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1521 DELACHAISE STREET  
MAY 12, 1952

### Uniformity in the Recording of Results in the Treatment of Cancer

To the Editor:

The literature continues to be replete with results of cancer therapy (surgical and radio-logical) reported in the conventional manner in terms of five-year survival. The implication is that all patients are reported in the series in question. Actually, this is not the case because the reported results are generally "too good." Unconsciously, in most reports, the authors exercise a degree of selection but do not indicate this. The purpose of recording five-year survivals should be to afford the medical public a more or less accurate conception of what is being accomplished in a given clinic by a given group of workers employing a given method or methods of treatment. In order to obtain such records a few simple rules are necessary but they should be rigidly adhered to. These rules are: (1) All patients once registered in the admissions clinic of that institution with a histologic confirmation of the disease secured either by biopsy in that clinic or by review of biopsy taken elsewhere immediately become the responsibility of that service to "cure." Nothing should mitigate against this responsibility. If the patient prior to treatment goes elsewhere, secures treatment, and dies of cancer in a relatively short time or within a period of less than five years, the clinic in which the patient pri-orily registered should still report that patient as a failure because that organization did not impress itself upon the patient in such a way as to cause him or her to follow out its recom-mendations. (2) If the patient went elsewhere and was cured, the clinic in question may cite this patient as among its five-year "cures" but does not claim credit for the treatment. (3) If the patient is deemed untreatable for various reasons and succumbs subsequently from cancer or any other cause, he or she must still be counted among the failures of that clinic be-cause a cure was not effected. Patients in the advanced stages of cancer desire to be cured just as fervently as those with early lesions and when a service does not bring this about that service has failed. There may be sound reasons for the failure, but the failure must nevertheless be counted. (4) Patients who register in the service, having been treated elsewhere without success, or who, interrupting treatment elsewhere and against other advice, are regis-tered in the reporting clinic where treatment may be continued, or where they may be referred back to the original clinic, and who subsequently die of cancer in less than five years must be carried on the rolls as failures of the reporting clinic. (5) Patients who once had cancer and who apparently are cured but are not traced at the end of the five-year period must be car-ried as failures because they once had cancer and are not observed as well at the end of the five-year period (though they might still be well). A rigid and efficient follow-up is a req-uisite for a service treating cancer and failure to carry this out must be reflected in statistical reports. These patients cannot be tossed out into a so-called "indeterminate group." The latter category should be deleted once and for all from every discussion of end results.

The purpose of the above discussion is in effect to propagandize for the reporting of unseเลcted series of patients. The question of importance is how many "cures" can be effected by a given clinic, from among all their patients. From the over-all large series, smaller groups can be singled out for special citation. For example, among all patients with carcinoma of the cervix, the group of patients with lesions confined to the cervix and *not treated elsewhere* might be the subject of discussion. Percentage of five-year survivors among these might be noted, but in the interests of accuracy and completeness mention should be made at the same time of what percentage of all patients seen in that clinic with this form of cancer the group

under special discussion represents. For example, if the five-year cure rate of cancer of the cervix limited to the cervix and not treated elsewhere is purported to be 68 per cent, mention should be made of what proportion this group represents of all patients with cancer of the cervix registered in that clinic and of what the over-all five-year survival rate is.

By such methods of reporting results, less confusion and fewer misleading impressions might appear in the literature, and the incidence of recording fantastic results in the treatment of cancer might in time be reduced.

ALEXANDER BRUNSCHWIG, M.D.

• 444 EAST 68TH STREET  
NEW YORK, N. Y.  
JUNE 28, 1952

### **Effect of Cortisone on the Fetus**

*To the Editor:*

We have had several patients to whom cortisone was given early during pregnancy. Although all of these patients have not yet delivered, the fetal outcome in several of the cases was not satisfactory. We are aware of several animal studies during which cortisone was given early in pregnancy with the resultant production of congenital abnormalities. If information is available concerning cortisone therapy in the pregnant woman and the subsequent outcome on the fetus, we would appreciate very much this information from readers of the JOURNAL, since our library facilities here are extremely scanty.

JOSEPH A. GUILBEAU, JR.  
CAPT., USAF (MC)

UNITED STATES AIR FORCE HOSPITAL  
MAXWELL AIR FORCE BASE  
ALABAMA  
JULY 31, 1952

### **Item**

#### **Seventh All India Obstetric and Gynaecological Congress**

The Seventh All India Obstetric and Gynaecological Congress will be held in Calcutta, Dec. 15 to 17, 1952. The chief subjects for discussion will be:

1. Cephalopelvic Disproportion
2. Nonmalignant Lesions of the Cervix

The obstetric and gynaecological societies all over India and abroad, as well as the teaching institutions and practitioners in the profession, are invited to take part in the deliberations of the Conference.

Those desirous of reading papers on any of the above-mentioned subjects are requested to communicate the title of the paper to us by Oct. 15, 1952, and submit a typed copy of the paper with abstracts by the end of October, 1952.

PROBODH DAS  
D. L. PODDAR

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